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DEVOTED TO THE IMPROVEMENT OF CITIES

CONCRETE CONSTRUCTION, PAVING, SEWERAGE, WATERWORKS, STREET LIGHTING, PARKS, GARBAGE DISPOSAL, BRIDGES.

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Municipal Engineering

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MUNICIPAL ENGINEERING

VOLUME XXXV. AUGUST, NINETEEN HUNDRED EIGHT. NUMBER TWO.

METHODS AND COST OF CONSTRUCTING CONCRETE SEWER.

By Charles M. Ripley, New York City.

AT Indianapolis, Ind., the municipal improvements have amounted to millions of dollars in the last few years, owing largely to the extension of the city limits, which included several suburbs where matters of large and necessary improvements were immediately required.

The sewer system of West Indianapolis is one of the largest enterprises now being carried through in this section, of which the Morris street branch alone has a length of 31,500 feet. This branch varies in size, but the section covered by this article is 7 feet in diameter and 1,130 feet long. The writer had the advantage of inspecting the work accompanied by a commercial photographer, and was also later given access to the cost records of the job.

The Julius Keller Construction Company, of Indianapolis, Ind., are the contractors for the entire Morris street branch, and the plant for the 7-foot section was brought to the job June 12, 1908, and on July 13, 1908, this section of the work had been completed. This work totals 7,000 cubic yards excavation to the average depth of 13 feet and an average width of 11 feet. The plant consists of the following:

One Moore trench digging machine (largest size).

Ten buckets of the bottom dumping type.

One No. 3 Emerson vacuum pump, with 5-inch suction and 4-inch discharge.

One No. 2 Foote concrete mixer.

One 20-horse power Lidgerwood engine and boiler for trench machine.

One 30-horse power boiler for pump.

One 10-horse power boiler for mixer.

Sixteen wheelbarrows, picks, shovels, etc.

The excavation work was done by the regular method of the Moore trench machine, in which the concreting goes on between the point of excavation and the back fill, the excavated material being carried back over the heads of men placing the concrete, and dumped back in place with only one handling. The speed of excavation was about 300 cubic yards per day, and each running foot required the excavation of five cubic yards. The material excavated was ordinary gravel during the majority of the distance, and part of this was used in mixing the concrete, being dumped near the mixer by the trench machine. Thus it was unnecessary to buy sand or gravel during the large part of the work.

There was an average of two or three feet of excavation below the water level, and the contractor had suspended from the frame work of the trench machine the steam pump with 5-inch suction and 4-inch discharge pipe. This was operated at about one-half of its regular capacity. The water came in so slow that the pump took air at every stroke. Mr. Keller explained that it was a great advantage to have a pump of large capacity do the work of a small pump throughout the day, especially when this same pump in the morning could be run at full capacity for fifteen minutes and empty the trench of the night's seepage, 2½ feet deep. He also stated that he considered it a good investment to have one pump capable of doing two kinds of work, thus making it unnecessary to have a smaller one for the light work and a large one held in reserve for emergencies. This pump was working in water so shallow that only about half of the strainer holes were submerged, and the steam valve was almost closed.

The cost of excavation work can be figured by comparing the average amount of 300 cubic yards per day with the following summary of the pay roll:

	Rate per day.
Time-keeping and superintendence	$6.00
Half of blacksmith's time at	1.25
One engineer for trench machine at	3.50
One engineer for boiler and pump at	3.50
Four teams scraping and hauling at	4.00
Forty men excavating and driving sheet piling with mauls at	1.75

The total pay roll was $100.25 a day, or 33.4 cents per cubic yard.

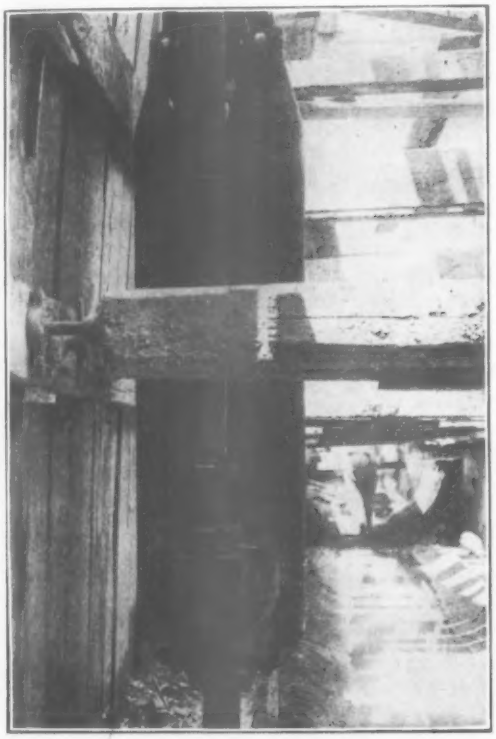
The average amount of concrete made per day in this 7-foot sewer was 58 cubic yards, or one cubic yard per running foot. Each cubic yard required 1¼ barrels of Lehigh Portland cement, at $1.40 per barrel.

The pay roll is summarized as follows:

	Rate per day.
Time-keeping and superintendence at	$6.00
Half of blacksmith at	1.25
Four carpenters on forms at	3.00
One engineer for concrete mixer at	3.50
Ten men with wheelbarrows at	1.75
Six men feeding mixer at	1.75
Four men placing concrete at	1.75

The sum of this pay roll is $57.75, or practically $1 per cubic yard. The cost of the cement, $1.75, added to this, makes $2.75, the other materials costing nothing but the handling, which is included in the cost of excavation above.

A very interesting feature was the method of removing the top section of the forms. Since the work progressed at 58 feet per day, and since the concrete was allowed to set from two to four days, depending upon the weather and depth of the back fill, it follows that the forms had to be dragged through the sewer from 100 to 200 feet, to be used again further on in the



CONCRETE SEWER CONSTRUCTION.
Morris Avenue, Indianapolis.

work. This process was greatly accelerated by letting about 6 inches of water run into the sewer, held there by small temporary dams, then the wooden forms would practically float out, owing to the buoyancy of the water. The upper half of these forms was the last removed, and was made up of two quarter sections. Since the bottom cross braces were about 4 feet above the center of the invert, there was ample room for these to be floated forward in the way mentioned.

The accompanying cut shows the construction of the invert in advance of the regular form work, and in the background the carpenters putting the sections of the forms together. They were floated out of the completed sewer below on the water shown in the invert, each quarter by itself, and the quarters are being joined into a half, ready for use. The method of drainage by a channel at the side of the excavation, draining from both directions to the foot of the pump, is also shown, as well as the method of sheeting and bracing adopted for the open gravel through which the trench runs, water rising at night about one foot at the point where this photograph was taken, to the water mark seen on the left. The trench at this point is about 10 feet deep.

WATER RATES AND RENTALS.*

By Charles Carroll Brown, M. Am. Soc. C. E., Consulting Engineer, Indianapolis, Ind.

THE current income of a waterworks plant comes, or should come, from two principal sources, the users of water and fire protection. The income from water users may be for actual consumption for domestic or manufacturing purposes, or from those who use water under pressure for power generation. Fire service may be supplied for general safety to the city or town or for private protection of factory, warehouse or other combustible property.

The division suggested in the subject of this paper applies the term water rates to the revenues received from users of water, and there is a more or less definite attempt to make the charge for such users proportional to the amount of water used. The term water rentals is intended to apply to the revenue received for fire protection. The value of this service bears no proportion to the amount of water used, and it is quite wrong to attempt to make the charge for this service depend in any way upon the amount of water used, or supposed to be used, for extinguishing fires.

The purity of the water supplies of this state is menaced in increasing degree each year, and the necessity of conserving it becomes greater by equal steps. This deterioration in public supplies must be stopped by reducing the amount of pollution reaching the water supplies and the quality of many water supplies in the state must be improved by removing from the water before it is used the impurities which it now contains. This statement applies to many underground supplies as well as to practically all the surface water supplies which are not already filtered. The smaller cities of the state, many of them, take their supplies from wells or galleries, and some of them are quite free from danger of pollution, but the limit of an underground supply is reached before the city reaches any great population, in economy if not in ability to supply the demand. It is unquestionably true that the supplies for the larger cities of the state must be taken from surface sources ultimately if they are not already so taken. The experience of Indianapolis in changing from wells to filters has been so satisfactory, both in quality of water and in quantity and possibly in cost, that it is likely to serve as an example for other cities as they reach a size sufficient to give rise to troubles in keeping up the supply and to demands for water more satisfactory for commercial purposes than the ordinary deep well water of the state.

This straining after additional supplies to meet the increasing demands for water, in some plants, and the purification of water which will be demanded in others will increase the cost of supplying water, and will re-

*A paper before the Conference of the Water Works Men of Indiana with the State Board of Health.

sult in a necessary increase in rates in cities where the rates have not been too high under the formerly existing conditions. Some discussion of the principles upon which water rates and rentals should be based is considered to be timely in the first conference which any large number of water-works men of this state have attended, for a change of rates means a new contract with the city for a water company, and it means complaints from the rate-payers for a municipal plant, and there must be a safe basis of fact and well developed theory in order to satisfy the other parties to the proposed new rate contract.

As to rates for water used. It is assumed that the books of the plant are so kept that the cost of supplying water can be ascertained, including all items of operation, maintenance, repair, renewal, interest, depreciation, sinking fund. There is much confusion in the meaning and application of these terms, but the limitations of this paper do not permit a discussion of this phase of the subject and the amount of revenue to be raised is therefore assumed to be known. The increase in cost of supplying water, due to the expense of the process of purification to be adopted, must be estimated unless the attempt has been made to operate without an increase in rates and the actual cost to run the purification plant has been ascertained. There has been no very systematic study of the question of rates. The present schedules of flat rates are unscientific and often far from equitable. They differ in various cities for special reasons and it is practically impossible to make comparisons of rates. Every plant should keep its books in such form that the source of all its revenues can be readily ascertained. A form like that accompanying will do this. It is only necessary to add up the various columns on the first page and multiply the sums by the corresponding rates to give the income from each class of service, subject to corrections in special cases by rebates and additions, made on the second page of the register. This is so easily done that it is surprising waterworks officials do not do it more frequently and then study carefully the effect upon income and upon customers of changes in the various rates. Then the superintendent should make some meter readings of the customary use of water in various fixtures and he can make some reasonable estimate of the proportion of his total pumpage which each class of fixtures uses.

Theoretically the cost of supplying water, beyond a readily ascertained minimum covering all charges for "readiness to serve," is proportional to the amount of water used. Practically, the water plant is disposed to encourage the installation of certain classes of fixtures and discourage the multiplication of others in the interest of the convenience of its customers on the one hand, and the conservation of its water supply on the other. Thus many plants make little or no extra charge for additional spring faucets in sinks or wash bowls in residences, convenience and not extra water being the reason for installing them, while they will make nearly or quite full charge for additional water closets, because of the greatly increased danger of waste with the addition of each closet. Such considerations as this can be taken care of in a well considered system of flat rates. No difference can be made under a meter rate, which must apply the same rate to all water passing through the same meter, no matter what its use, unless by estimate on an agreed basis. The question of meters or flat rate services is an interesting one and belongs to this paper, but limitations of time prevent its consideration.

The water assessor and collector of St. Louis recently published a statement of the receipts of his department for six months, giving the details of receipts from various sources as shown in the accompanying table, to which is added a column showing the percentage of the total which each item shows.

Even with such a guide as this there will be much difference of opinion regarding the propriety and the proportion of the various rates. This difference of opinion will be less among the officers of an individual plant, who have a similar statement of the returns from their own schedule of rates before them, than it would be in a body like this, which is discussing the general features of the problem.

Whatever the schedule of rates may be, unless it has been really higher than it should be, it must be increased when the expense of water purification is added. This expense is a burden put on every gallon of water, and it should be added to every gallon of water delivered. With the flat system of rates this can scarcely be done unless the measurements of the use of water by various fixtures have been

Sources of Water Income in St. Louis.

	No. using water.	Rate 6 mo.	Total.	Per cent. of grand. total.	Partial totals. Amount.	Per ct.
Domestic Uses—						
Residences:						
1 to 3 rooms	16,860	$1.00	$16,860.00	1.79		
4 to 5 rooms	24,635	1.50	36,952.50	3.93		
6 rooms	10,141	2.00	20,282.00	2.15		
7 rooms	3,783	2.50	9,457.50	1.00		
8 rooms	3,679	3.00	11,037.00	1.17		
9 rooms	2,346	3.50	8,211.00	0.87		
10 rooms	1,172	4.00	4,688.00	0.50		
11 to 12 rooms	1,015	4.50	4,567.50	0.48		
13 to 14 rooms	313	5.00	1,565.00	0.17		
15 to 16 rooms	97	5.50	533.50	0.06		
17 to 18 rooms	25	6.00	150.00	0.02		
19 to 20 rooms	35	6.50	227.50	0.02		
					$114,531.50	12.16
Tenement rooms	217,195	0.50	108,597.50	11.54		
Private baths	52,598	1.00	52,598.00	5.59		
Water closets	67,316	1.50	100,974.00	10.73		
Beds in lodging houses	2,392	0.25	598.00	0.06		
Sprinkling			34,901.00	3.71		
					412,200.00	43.79
Public Uses—						
Public baths	172	7.50	1,290.00	0.14		
Public water closets	206	5.00	1,030.00	0.11		
Public urinal basins	709	10.00	7,090.00	0.75		
Churches	218	5.00	1,090.00	0.12		
Club rooms	62	10.00	620.00	0.07		
Schools (scholars)	14,728	0.02½	368.00	0.04		
Halls	193	2.50	482.50	0.05		
					11,970.70	1.28
Animals—						
Horses and mules	10,940	1.50	16,410.00	1.71		
Cows	3,923	0.50	1,961.50	0.21		
Vehicles	5,919	1.00	5,919.00	0.63		
Stable hose	672	2.50	1,680.00	0.18		
Livery hose	23	25.00	575.00	0.06		
Dairy hose	122	10.00	1,220.00	0.13		
Stalls in stables	955	1.00	955.00	0.10		
					28,720.50	3.02
Business houses (i. e., shops, stores and offices):						
Stores	3,084	5.00	15,420.00	1.64		
Shops	6,943	2.50	17,357.50	1.84		
Offices	2,130	2.50	5,325.00	0.57		
Barber shops:						
1 chair	14	2.50	35.00			
2 chairs	270	3.50	945.00			
3 chairs	204	4.50	918.00			
4 chairs	42	5.50	231.00			
5 chairs	12	6.50	78.00			
6 chairs	9	7.50	67.50			
7 chairs	1	8.50	8.50			
			2,283.00	0.22		
Beer pumps	308	10.00	3,080.00	0.33		
Billiard tables	453	1.50	679.50	0.07		
Candy and ice cream saloons	57	7.50	427.50	0.05		
Restaurants	268	10.00	2,680.00	0.28		
Saloons	1,578	10.00	15,780.00	1.68		
Lunch rooms	212	7.50	1,590.00	0.17		
Photo galleries	11	10.00	110.00	0.01		
Tenpin alleys	136	1.50	204.00	0.02		
Warehouses	398	2.50	995.00	0.11		
Washing bottles	73	12.50	925.00	0.10		
Buildings	....	....	22,197.50	2.36		
					89,054.00	9.45
Manufacturing Purposes, Small Shops—						
Tobacco and cigar factories	79	5.00	395.00	0.04		
Bakeries	261	5.00	1,305.00	0.14		
Ovens	368	5.00	1,840.00	0.19		
Foundries and forges	302	1.50	453.00	0.05		
Dyeing and cleaning shops	17	12.50	212.50	0.02		
Laboratories	33	12.50	412.50	0.04		
Laundries	153	10.00	1,530.00	0.16		
Hot houses	149	2.50	372.50	0.04		
Soda water factories	24	25.00	600.00	0.06		
Minnow tanks	9	7.50	67.50	0.01		
Boilers	434	....	5,771.50	0.61		
Hands employed in shops	9,572	1.00	9,572.00	1.02		
Gas engines, 285-h.p.		1.50	427.50	0.04		
					22,959.00	2.42
Meters			367,823.80	39.08		39.08
Permits and taps			7,963.95	0.85		0.85
Miscellaneous			673.95	0.07		0.07
						99.96

made, so that the superintendent has some knowledge upon which to base an estimate of the relative increases that should be made in the rates in order to bring the additional revenues required. The simplest method of making the addition is by increasing the income from each rate, as shown by such a table as that of St. Louis, by its percentage of the whole and then increasing the rate itself the amount necessary to produce this increased amount. This required increase in income makes it possible, however, to readjust the existing rates so that they shall be more nearly in accord with a well considered system, by placing the increase on the rates which are proportionately too low. This method of increasing the rates should bring less complaint from customers as well as supply valid arguments to meet such complaints as may be made.

For the water supplied by meters the problem of proportionate increase in rates is simpler. Some may say at first glance that it amounts simply to the addition of a percentage to the existing rates, and this is true if there is but little variation in the sliding scale. But, as already stated, the cost of purification is a burden on every gallon of water and it would seem to be most equitable to make the increase by the direct addition to all of a rate per gallon based on the total increase in cost and the total amount of purified water delivered.

The water used in putting out fires is not materially improved for that purpose by the process of purification and it would seem proper, if the payment for that service is already on a proper basis, that its price should not be increased. However, so far as the public fire protection service is concerned, the city at large is vitally interested in the supply of pure water and should be willing, through its general fund, to pay a material proportion of the cost of purification. Indeed, in some cases, particularly in municipal plants, the city at large should pay the whole cost of purification, and even then would not be paying its fair share of the support of the water plant. Some discussion of this subject is necessary because very few cities pay the correct amount for their fire protection and public uses and the required increase in rates will give an opportunity to make the correction.

Supply of water to actual users of water requires comparatively small pipes, only sufficient to carry the maximum draft at any time of the day, week and year, which is probably less than three times the rate of flow for the average consumption. Supply of water for fire protection requires pipes large enough to make it possible to deliver a large amount of water in a very short time to a restricted district. Except for this short time, which may recur at very infrequent intervals in any one locality, the large size of pipes is of little practical benefit to the system.

An application of the theory that the hydrant rentals for fire protection should pay the charges due to this increase in size of pipes and in capacity of pumps and of water supply was made a few years ago by D. H. Sawyer, in a paper an abstract of which was published in MUNICIPAL ENGINEERING, vol. xxiv, p. 182, and discussed editorially on page 189. He took four towns and cities, ranging in population from 1,000 to 35,000, but otherwise under similar conditions, and designed plants for domestic service only and for combined domestic and fire service (with no cost of water purification). He assessed the annual charges necessary to take care of the difference in cost upon the hydrants and found the rates per hydrant to range from $46.49 to $58.86, averaging $51.12 per hydrant per year. This average happens to agree quite closely with $47.88, the average in 32 cities of the middle west of 500 to 105,000 population, and $49.43, the average of 544 cities in the whole United States. In the first group of cities the range is between $33 and $80, and in the larger group it is between $5 and $160, so that, while the averages are quite near the theoretical rental, according to Mr. Sawyer, individual cities vary widely from it.

In his presidential address before the American Water-works Association in 1907, published in MUNICIPAL ENGINEERING, vol. xxxiii, p. 167, Mr. D. H. Maury discusses this same question, and he states that an average of available estimates by eminent authorities shows that the average annual cost of furnishing fire protection is about 50 per cent. of the interest and other fixed charges due to the cost of construction of the works plus about 20 per cent. of the annual operating expenses. Mr. Sawyer's cases do not vary greatly from this estimate. The individual city or town should make these computations for its own particular case and should base not only its public hydrant rental charge upon them, but also its charges for such private services as automatic sprinklers, private hydrants, stand pipes, etc.

RATED WATER

American Water Works Standard Bookkeeping System. Copyrighted by Municipal Engineering Co., Indianapolis. Patent Nos. 79,136, 79,137.

Line No.	Serv. No.	Street No.	Name and Street	Taxable Feet	House Rooms	Hotel	Store	Office	Saloon	Riding House	Water Closet	Bath Tub	Urinal	Sprinkler, No. Feet	Lawn Sprinkler, No. Feet	Horses	Carriages	Cows	Livery Stable	Bank	Retail Barber	Dining Room	Motors	Special					Date On	Date Off	Season Rate	Annual Rate	Line No.	
1																																1	
2																																2	
3																																3	
4																																4	

Headings of Lefthand Page of Rated Water Register, Quarterly Payments.

REGISTER.

	189.. Quarter	Quarterly Rate	Addition	Reduction	When Paid	Amount Paid	Cash Folio	Del'q'y Reg'r	Remarks	189.. Quarter	Quarterly Rate	Addition	Reduction	When Paid	Amount Paid	Cash Folio	Del'q'y Reg'r	Remarks	189.. Quarter	Quarterly Rate	Addition	Reduction	When Paid	Amount Paid	Cash Folio	Del'y Reg'r	Remarks	Line No.
	First									First									First									1
	Second									Second									Second									2
	Third									Third									Third									3
	Fourth									Fourth									Fourth									4

Headings of Righthand Page of Rated Water Register, Quarterly Payments.

If the city has been paying less than the amount thus computed, enough of the added cost of purification should be put on the city fire protection charge to bring it up to its proper basis. If the city has been paying more, then the greater part of the charge should be put upon private rates. This should be done whether the plant is under private or municipal ownership.

City payments are sometimes disguised so that the actual amount paid by the city must be carefully investigated. In some cities under municipal ownership there is no charge for hydrant rental, but interest charges, repayment of bonds, appropriations to meet deficiencies, etc., may equal or even exceed a proper hydrant rental. This is bad bookkeeping and should be corrected. A long paper could be written on this subject, which is closely connected with the subject of this paper, but cannot be considered here.

COST OF ROAD BUILDING.

THE annual reports of the State Commissioner of Public Roads of New Jersey contains fairly well detailed statements of the cost of construction of roads built under his supervision and a few of the figures are selected from the last three reports, these particular roads being selected because the accompanying pictures, for which we are indebted to Commissioner E. C. Hutchinson, show sections of these roads before and after improvements and thus give a better idea of the character and amount of work done than could be obtained by description.

The first two pairs of pictures show two sections of the Westfield and Camden turnpike in Burlington county, one section through the fields and the other through the town of Westfield. The portion constructed under this contract is 1.2 miles long (6,385 feet), 14 feet wide and 10 inches deep, and is the extension of the macadam pavement heretofore constructed on this road. It is a natural thoroughfare from northern Burlington county to Camden and Philadelphia. Gravel shoulders 5 feet wide were made on both sides of the road for its whole length. The area of the shoulders is 1,792 square yards. The roadway proper is mostly telford, there being 9,932 square yards of this construction, costing 91 cents a square yard, and 328 square yards of macadam at 53 cents. These three items make the contract price of $9,300. In addition to this cost there are charged to the road 310 cubic yards of extra earth excavation at 24 cents, or $74.40; a portion of the supervisor's salary, $294.00, and engineering expenses, $187.48, making the total cost of the roadway $9,374.40, or $1.47 per lineal foot, for a pavement 14 feet wide, or including shoulders, 24 feet wide. The maximum grade on the road before improvement was 6 per cent. This is reduced to 2.94 per cent. One-third of the cost of all these roads was paid by the state.

The third pair of pictures shows views of a heavy rock cut on Bradford avenue in Essex county. This improvement amounted to the building of a new road across First Watchung Mountain from Mountain avenue in Upper Montclair to the Essex County Hospital for the Insane. The maximum depth of the cut is 32 feet, and loam, gravel, brown sandstone and trap rock were removed from it. The improvement is 1.46 miles, or 7,689 feet, long, the roadway is graded 40 feet wide and a telford pavement is constructed through its center 16 feet wide and 8 inches thick. There was 79,129 cubic yards of excavation, costing 89 cents a yard, or $70,424; 13,929 square yards of telford at 55 cents, or $7,660.95; and 1,933 square yards of cobble stone gutter at $1, or $1,933.00. The total cost of the road is therefore $80,018.76, or $10.46 a linear foot. No charge was made to the road for engineering or supervision. The maximum grade of 17.04 per cent. was reduced to 9.45 per cent. by the improvement.

The fourth and fifth pairs of pictures show two views of Old York road in Hunterdon county. One section of this road 5.55 miles long was improved in 1906 and another section 5.37 miles long in 1907. The road is a through line from the largest town in the county to the county seat, through a peach county. The improvement is of macadam 14 feet wide and 6 inches deep, except about ¾-mile over bad bottom land, which is 14-inch telford. The earlier improvement was 29,323 feet long and included 39,822 square yards of macadam at 65 cents; 5,791 square yards of telford at 95 cents;

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353.6 square yards of extra macadam a 32½ cents, 32,966 cubic yards of excavation at 50 cents; 60 linear feet of 4-inch drain tile at 20 cents; 30.2 cubic yards of concrete at $8; 358.7 square yards of cobble stone gutter at 20 cents; and $353.70 worth of excavation in approaches. The original lump sum contract was for $47,900.49; there were $722.22 of extras; $660.00 supervisor's salary and $1,070.20 further extras paid by the county, making a total of $50,352.91, or $1.72 a linear foot.

The later improvement was 28,225 feet long and included in the original contract 42,692 square yards of macadam at 60 cents; 1,244 square yards of telford at $1.88; 18,419 cubic yards of earth excavation at 50 cents; 6,662 cubic yards of borrowed excavation at 40 cents; and 325 linear feet of drain at 25 cents, making a total of $39,826.62. Extra excavation cost $1,178.58; the supervisor's salary was charged at $531.00; extras paid by the county cost $4,080.09; making the total cost of the road $45,606.29, or $1.61 a linear foot. The cost of the whole road was $1.66 a linear foot. Grades were reduced from 8 to 5.66 per cent. and from 8.6 to 4.4 per cent.

The sixth pair of pictures shows a section of a road from Landing Bridge to the Stelton stone road, 2.05 miles, or 10,830 feet long, which runs through a dairy country and shortens the route to New Market, Dunellen and other towns to the north of New Brunswick. The cost was about $270 less than the contract price, and included 14,440 square yards of macadam at 72 cents; 5,938 cubic yards of excavation at 55 cents; 18 linear feet of drain at 18 cents. The supervisor's salary was charged at $702.00 and there were $938.88 of extras paid by the county, making the total cost of the road $15,663.56, or $1.45 a linear foot. This road was improved with macadam 12 feet wide and 8 inches deep, and maximum grade was reduced from 4.50 to 2.43 per cent.

UNDERGROUND WATER SUPPLY OF INDIANA.*

By Frederick G. Clapp, U. S. Geological Survey, Washington, D. C.

THE area investigated includes nineteen counties in north-central Indiana, extending from the southern boundary of Hendricks, Marion and Hancock counties northward to the Michigan line. Practically every city, town and village in this area was visited and conditions in the country districts were investigated, as well as those in the towns. While, on the whole, the geologists were impressed with the excellent quality of northern Indiana water, this must be recognized as due not entirely to any real superiority over other regions, but largely to the fact that the progress of civilization has driven all enterprising communities, as well as individuals, far below ground in search of more potable supplies than can be obtained on or near the surface.

It has been interesting to compare the towns using underground waters with those using waters from surface sources in the nineteen counties studied. Of the fifty-four communities having public supplies two use lakes, three use streams, three use both streams and wells; one town uses springs and forty-five use wells only. In other words, forty-nine out of the fifty four communities obtain all or part of their water from underground sources.

In order to compare the quality of surface and underground waters a table was compiled giving the sources and sanitary character of waters of all public supplies in the nineteen counties. From this, it was found that of the five communities using lakes and streams none could be said to have water of desirable quality; of the three communities which have both streams and wells one, Indianapolis, has good water, chiefly because the city has installed an excellent filtration system. Out of the forty-five communities that use wells alone, forty-one were found to have water of the best potable quality. A similar proportion exists in other states that have been investigated.

Nearly all the wells used for town supplies are deep drilled or driven wells, but a few towns use open wells. As a rule, open wells are fully as objectionable when for public supplies as

*From a paper before the Indiana Water and Public Health Association.

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when used for private houses, for they allow the entrance of surface drainage and infiltration of the polluted waters which are present in the upper strata of sand or gravel.

The ground waters of the state are derived from the glacial drift which underlies it in depths varying from a few feet to several hundred feet in the northern counties, from the alluvial sands and gravels of the river bottoms, or from the sandstones, limestones and shales of the various geologic formations beneath the drift. The waters from all these water-carrying beds contain mineral matters in solution, the quantity and character of the constituents depending upon the formation from which the water is derived and upon the depth of the well. The analyses may be summarized by stating that practically all limestone waters and waters from gravel wells over 500 feet deep are to be preferred for domestic purposes to waters from gravel wells less than 500 feet deep. For manufacturing or boiler purposes, surface waters are superior, but of the ground waters, those from wells in gravel and between 50 and 100 feet deep average better than others, in that they show the lowest maximum, lowest minimum and lowest average amounts of scale-producing minerals.

Scattered throughout the state are many localities of small extent where flowing artesian waters can be obtained. The flows are due to one of two causes: (a) Where the water is struck in the Niagara limestone it may owe its head, in certain cases, to the pressure derived from its highest elevation, about 1,200 feet above tide near the Ohio line east of Randolph and Wayne counties, Indiana, where the Niagara limestone reaches the surface 200 to 400 feet higher than its usual altitude in Indiana, in which class some of the flowing water from gas wells may belong. (b) The large majority of flowing wells, however, particularly those along valleys, are believed to owe their head to local causes—to the transmission of pressure from some neighboring elevation in the drift-covered surface of the state. The flows in some rock wells, as well as in drift wells, belong in the latter class. Tne pressure is transmitted from the water stored in the drift to that contained in the limestone below.

Well known examples of flowing wells are situated along Wabash river, White river, and Fall Creek. The towns of Danville, Wabash, Middleton, Portland and North Manchester are fortunate in getting their supply by a flow which saves the expense of pumping.

Such conditions are not destined to last, however, unless proper precautions are taken. For the past few years the ground water level beneath large areas has been falling, having lost 15 to 25 feet in the past twenty-five years. For this reason many people in the country districts who use open wells have found it necessary to deepen their wells or to change from open to driven or drilled wells. There is another way in which the decline of the ground water supply can be proved, that is, by observation of the flowing wells and of water flowing to waste from the casings of old gas wells. People who are familiar with these wells know that many which were drilled years ago have now ceased to flow entirely, and almost every such well diminishes appreciably within a few years. This statement is particularly true in Madison, Delaware, Henry, Hamilton, Tipton, Grant and Howard counties, but also elsewhere. All water-works engineers and superintendents know that they have to install new wells more rapidly than the population is increasing. All evidence goes to show that the ground water level is slowly subsiding.

Such a decline is not peculiar to Indiana. It was observed in the artesian well districts of Florida, where the head in certain sections along the East Coast and St. Johns river has declined notably. It has also been recorded as a result of investigations by the United States Geological Survey in the Great Plains, in southern Michigan and in Southern California, where the artesian basins have decreased in area, the ground water level has declined and the yield of flowing wells has diminished.

At Chicago the first flowing artesian well was drilled in 1864, and the water rose 80 feet above the surface or 111 above Lake Michigan. The flow has long since ceased and the head has declined until now the water stands 15 or 20 feet below the surface, or 100 feet lower than its original head. In the past there have been a great many flowing wells in Chicago, but the number of wells drilled is so great and the draughts upon the water-bearing strata are so heavy that now a flow can rarely be obtained.

The causes of this decline are various and differ somewhat according to locality; but in all localities certain common causes prevail which are operating to this end. In Indiana, the

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After Improvement, 33 ft. Cut.

III. BRADFORD AVENUE, WESTERN SLOPE, ESSEX COUNTY.

decline is believed to be due principally to the following factors, in the order of their probable importance:

1. Waste of water.
2. Surface drainage by ditching for cultivation.
3. Overdevelopment of underground waters.
4. Deforestation of the state.

The ground water supplies have always been regarded as inexhaustible, as the nation's wealth in forest, soils, oil and gas once was, but in a very few years oil and gas fields have been entirely exhausted, soils have been worked to exhaustion by unskilled farmers and the great forests which once covered the country are now nearly gone. The need for preserving the remnants of these and other natural resources was what led President Roosevelt to call the recent conference of Governors. Water, which is the most abundant of all natural resources, is sure to become a luxury also if the present generation does not take proper precautions.

Many of the flowing well areas in Indiana have been personally visited by survey investigators, and the most conspicuous fact noticeable everywhere was the recklessness with which the best ground waters are wasted. In driving through Madison, Delaware, Henry, Hamilton, Tipton, Grant, Howard and other counties, hundreds of wells were seen from which the pure water from the Niagara limestone was flowing to waste on the surface. More than half the flowing wells in these counties were orginally drilled for oil or gas. In such wells the drive pipe is sunk to the top of the limestone, and the casing inside that to the bottom of the limestone. The water rises between the drive pipe and the casing and overflows at low points along valleys or other depressions in the surrounding plain. Normally, the Niagara limestone is 200 to 500 feet thick, and the flow from it ranges from 1 to 60 gallons per minute.

In Madison county, the flowing wells are most numerous along Fall Creek, Lick Creek and White river. A conservative estimate of the number of flowing deep wells in that county is placed at 100. The usual volume of flow is probably 5 to 20 gallons per minute, but many wells yield more than this, and probably bring the average flow up to at least 20 gallons. On this assumption, the amount of water wasted every minute in Madison county alone is 2,000 gallons, making the amounted wasted in a day about 1,700,000 gallons. If this were all in one place it would be ample to supply a city of 30,000 inhabitants. In some counties single wells have been seen which would supply half this number. If the conditions were distributed over the entire state the loss per unit of area would be infinitesimal in amount; but we should remember that the waste is centralized along certain valleys where flowing wells are most abundant. Moreover, this water is not derived from some distant "inexhaustible" source, like Lake Erie, as some have assumed, for in that case it would be necessary for the water to run uphill. Nor is there any great part of it presumably transported from the high lands in Ohio, for in that case, the high land, which only covers a portion of a single county, would soon be drained dry. On the contrary, nearly all water from deep wells in the Niagara limestone is derived from the rainfall within a few miles or even a few hundred feet of the well, where it penetrates the drift and enters the porous limestone below. When a well is drilled, if its elevation is not too great, the pressure of water in the overlying drift causes the water to reach the surface and we have a flowing well.

Water is wasted in other ways, as witnessed by the sad fact that, while 40 gallons per capita should be ample for all needs in an ordinary city without much manufacturing, most water works are furnishing several times this amount. For this evil, the meter is the remedy, as there is no logical reason why a person should not pay for the actual amount of water he uses, as he does in the case of gas or electricity. Careful investigation of city water distribution systems anywhere usually quickly converts the investigator into an earnest advocate of the meter system.

A full conservation of the underground water supply is, of course, impossible, because the water is becoming more and more necessary for use. We could not and should not interfere with the right of a well owner to use the water, to the full capacity of the well, if it is all serving a useful purpose. But, for the reason that new wells are being continually drilled by parties demanding a similar supply we ought not to allow water to be wasted. Legislation should be enacted providing that all flowing wells, whether drilled for gas, oil or water, should be capped or otherwise shut off when not in use, and when in use only a stream of the requisite size should be allowed to flow. Even if the amount of water

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saved were infinitesimal when compared with the total underground supply, the very act of putting it to some use would be an economic gain. Where water occurs along creek bottoms below houses, rams can be installed and the water made available for domestic purposes by raising to the plains above. Or, even the formation of fish ponds or bathing pools would be improvements on the present indifference to waste.

A number of states in this country have already realized the importance of forbidding the waste of water from wells and California, Colorado, Nebraska, Michigan, South Dakota and Washington have passed laws to that effect. The California act was passed and approved as long ago as 1878, and is a fair sample of what these should be. It provides:

(Sec. 1.) "Any artesian well which is not capped or furnished with such mechanical appliance as will readily and effectively arrest and prevent the flow of water from such well is hereby declared to be a public nuisance. The owner, tenant, or occupant of the land upon which such well is situated who causes, permits, or suffers such public nuisance, or suffers or permits it to remain or continue, is guilty of a misdemeanor."

(Sec. 2.) "Any person owning, possessing or occupying any land upon which is situated an artesian well, who causes, suffers or permits the water to unnecessarily flow from such well or to go to waste, is guilty of a misdemeanor."

The acts of the several other states are similar. In California, the penalty is a fine of not less than ten or more than fifty dollars, together with the cost of prosecution. In Colorado, the fine is not less than fifty or more than three hundred dollars, together with the cost of prosecution.

THE COLLECTION OF WATER BY GALLERIES AT THE RICHMOND, IND., WATERWORKS.*

By Howard A. Dill, Superintendent Richmond City Waterworks Company, Richmond, Ind.

THE supply at Richmond is derived altogether from infiltration galleries or wells.

The system was inaugurated in 1884, and the pumping station located three miles east of the city on a branch of the Whitewater river. The geological formation around Richmond is such that deep wells are not available for a supply. There are frequent outcroppings of limestone, overlaid with gravel, and small spring streams are numerous. Test wells for natural gas failed to develop water veins of any consequence below the strata of limestone. This condition necessitated the use of infiltration galleries, as the city would not permit the use of water from the above stream.

Gallery No. 1 is parallel with the stream and about 20 feet from it. It is 2 by 3 feet in section and 1,000 feet in length. No test has been made of the flow, but I believe it is capable of supplying one million gallons in twenty-four hours. A second gallery was laid in 1887, about one-quarter of a mile beyond Gallery No. 1, but at a greater distance from the river. Its bottom is 12 feet below the surface, the walls are laid in stone 2 feet thick and 3½ feet in height, with a distance of 3 feet between the walls. A two-ring brick arch is laid on top of these walls. The length of this gallery is about 500 feet. It has not given good results, and is not depended upon.

Gallery No. 3, about 1,000 feet in length, is located one and a half miles from the pumping station, to which the water is carried by a 12-inch iron pipe. This gallery is situated 100 to 500 feet from the stream and furnishes about one-half million gallons a day. All of these galleries derive their supplies from the land side and very little water is received from the river side.

In 1896 an additional supply was investigated, located in a different watershed about two square miles in area. Tests showed a deep underlying stratum of gravel with the water level standing from three to five feet below the surface. Geologically, this watershed appears to be the former bed of a large river, filled with gravel. A

*From a paper before the Indiana Water and Public Health Association.

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siphon line, 16 inches in diameter, conveys the water to the pumping station three miles distant, with a difference in elevation of 90 feet between the well and the station. The description and operation of this siphon was described in the proceedings of the American Water-works Association for 1908, in a paper published also in MUNICIPAL ENGINEERING, vol. xxxiv, p. 340. Approximate estimates show this watershed to have a daily capacity of two million gallons. At present from 750,000 to 1,000,000 gallons are utilized. It is a water of unusual purity and clearness with a temperature of 52 degrees at the well in summer.

From the receiving well at the pumping station the water is pumped to the city or to the reservoir. The latter originally had bouldered sides and clay bottom. About 1898, a disagreeable taste was noticed and traced to the reservoir, where small growths of algae occurred. These were removed in winter by emptying the reservoir and allowing the mud to freeze. In 1903 this condition became so bad, the algae covering the entire bottom, that it was decided to cement the bottom. This remedied the trouble for a few years, but the taste again became disagreeable. Consultation with the Department of Agriculture at Washington resulted in recommendation of the use of copper sulphate. This was tried with only temporary relief. In 1906 the company engaged Dr. Geo. T. Moore to investigate the situation. His report showed the trouble to be in the mud between the boulders of the reservoir, the copper sulphate not destroying the roots of the Chara. In his report Dr. Moore recommended the use of 100-pound doses of copper sulphate, or the lining with cement of the bouldered sides. Two applications were made within the next year, but with only temporary success. In 1908 the company concluded to resort to cement as a means of removing this annoyance. The work was completed in November, 1907, and very little, if any, taste is now apparent. The 20-inch inlet and outlet pipe of the reservoir is situated in one corner. By means of two check valves and a 12-inch line laid to the opposite corner, a better circulation was secured. The total cost of the work in 1903 and 1907 amounted to $15,000, and it is considered a good investment. At the time of Dr. Moore's investigation in 1906 he also found evidences of crenothrix in the siphon well. Several applications of copper sulphate have been made in the well, and it is believed this trouble will be removed in a short time.

EXPERIENCES WITH SALT WATER AND OIL IN A PUBLIC WATER SUPPLY.*

By Quince Walling, Superintendent of Waterworks, Muncie, Ind.

THE main pumping plant of the Muncie Water Works Company is located 2½ miles east of the city, on the banks of White river. Our supply, at the time this subject will refer to, was taken from deep wells and White river, using the river in case of fires and at times when the consumption ran beyond the capacity of the wells.

In order to show you that the water company had taken all the precaution that any one could, under ordinary conditions, I will read a few extracts from a report made to the city of Muncie by Charles Carroll Brown, employed by the city in the year 1897 to make a report on conditions of our plant. His report on White river for a water supply is as follows: "The sanitary condition of the river water is unusually good. The condition of drainage and the small amount of pollution entering the river above Muncie, make the water a good, potable water, if proper steps are taken to filter it and remove the organic and inorganic matter contained in it when the rains wash the soil into the river. For many purposes the river water is better than well water."

I want to add to Mr. Brown's report at this time that White river was one of the most beautiful small streams of water that I ever looked at. Its source is about 22 miles east of Muncie, and with no sewerage coming into it from cities. It is fed by springs from one mile east of us the entire distance, first being the famous Inlow Springs and the Rees Springs, and many more that I could mention, mak-

*From a paper before the Indiana Water and Public Health Association.

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VI. LANDING BRIDGE AND STELTON ROAD, MIDDLESEX COUNTY, N J.

ing a nice, clean, clear water, running over gravel and lime rock, a supply that no good engineer would hesitate to recommend for a water supply for any city.

In the year 1889 we found that our well water supply began to fail, and the water company decided that we would put in some more wells. Accordingly, six additional wells were added to the twelve that were already in. Our wells are located along the banks of White river, covering a distance of a little over 7,000 feet. To these wells we have attached one 12-inch and one 14-inch suction line laid in the river, running to what we call our receiving well. This is built of brick, 25 feet in diameter and 40 feet deep. Into this well we drop our suction lines about 30 feet and attach to them a vacuum pump, and siphon the water from wells into the receiving well, and from here we pump direct to the city. In doing this work in this way we were compelled to lower our pumping machinery down in pits about 14 feet, so that the suction lift would not be too much. This increased our supply considerably, and we were much pleased with results, but our city was growing very fast, and knowing in our own minds that we would soon be in trouble again as to supply, we decided to put in a filter plant so that there would be no danger of shortage any more. This was completed in 1900, and the water company congratulated themselves on having the water supply question solved for all time to come, as far as Muncie was concerned; that all that would ever be needed would just be additional filter capacity. But even water works people get fooled once in a while.

Along in 1902 oil was discovered in the Delaware county field, on what was known as the Daniel Boone lease, located two miles east of our water plant. Every one went wild; all the land from the city limits to the edge of Randolph county was leased. Oil companies were organized, and it seemed to me that every one of them thought the oil was all along White river. In the short space of eighteen months there were over 600 oil wells dumping their salt water and refuse oil into White river, ruining the stream and making it unfit for use of any kind. Here we were, with our money invested in a filter plant and no water to use in it except White river. The chlorine tests made after oil developments were started showed from 500 to 1,100 parts per million, while under normal conditions it was from 40 to 100 parts per million. With these comparisons you can draw your own conclusions as to whether the water had a brackish taste or not. The oil would come down past our plant in patches 50 feet square, and I have seen the river covered for half a mile with this dirty black oil. It was not a hard matter to get rid of this, as we had arranged some timbers on our dam so that the current of water could be changed and allow this to go on down stream for Indianapolis and Anderson to handle; but when the salt water got thoroughly mixed, this was the sticker; stock would not drink it and it killed the fish by the thousands. At one time there was by actual measurement, and this was not all, over three million gallons of salt water going into White river from our plant up the river to Smithfield, a distance of four miles. From the experience that others had had, we figured that we could handle it all right, but conditions were different. As I understand it, these other fields did not have the salt water to contend with. We thought that with as little water as we were using from the river, and mixing it with the well water, the taste would not be so bad. So we kept up the filtration, pumping from a gallery connected to the river, and found at times we would get some bad water. Then we constructed a large steel tank, putting it up high enough that the water would flow to filters by gravity. On this we piped the water to the top and let it flow out over the sides of the pipe in thin sheets, dropping it on a screen with ¼-inch mesh, forcing the water to drop on bottom of tank the same as rain, giving it good aeration. We still got some bad tasting and smelling water. Then we tried aeration after filtration, by constructing a wooden frame four feet square and ten feet long. In this we placed four screens of different size mesh wire—¼-inch and smaller—attached this to the outlet pipe of filters, and made the water go into receiving well in a regular shower, striking a 10-foot platform before mixing with the well water. This did fairly well, and we were getting along in fairly good shape, but the citizens were complaining some, and, not being satisfied, we decided to try out the air lift. So one was installed on the wells at the plant. After spending some $12,000, we found that we were getting no better results than with our siphon system. But the air lift was our undo-

ing. One warm Sunday in July we were running along, thinking everything was all right, when the compressor let go, bursted heads out and tore the machine up in general, and then we were up against the real thing. For a few days we were forced to furnish river water alone to the city; the memories are not pleasant. The newspapers went after us rough shod; no one had a good word for us. Our domestic consumers were getting water for drinking purposes wherever they could. The steam users were trying to sell us salt that they had collected from small leaks on their boilers. The City Council, Board of Works and Commercial Club took up the cause and used the big roller just as hard and as often as they pleased; every one had his turn at us. The Commercial Club even got Dr. J. N. Hurty, of the State Board of Health, to come to our city and investigate the situation and to address the citizens on the evening of his visit, after going over the plant and seeing the condition of White river.

I will give you a few extracts from Dr. Hurty's talk: "We Americans are so used to hanging onto our eyebrows that we don't shudder any more. Muncie is in a precarious condition, at present, from her water supply—that much has been revealed to me to-day. Germs and impurities of all description may be removed by filtration, but the taste of salt and oil, be the filtration process ever so perfect, cannot be eradicated until their presence in the stream is no more. Deep wells will solve the problem, as it is the only available supply at this time." The latter remark of Dr. Hurty is where I took exceptions. We had at this time information enough on the deep well question to fill a small book. On our own system we had eighteen of the best wells in Delaware county, covering a distance of 7,000 feet from our pumps and affecting all the wells within 1½ miles of them, and it was not practicable to go any farther. We also had information in regard to the other wells over the city, supplying our manufacturing concerns, that they were not getting out of all of these wells combined over 750,000 gallons of water per day of 24 hours. When the head of ground water falls from 6 feet above the surface to 30 feet below, it makes one feel as though the water supply question was getting serious.

This was not all of our trouble. At this time we found that the farmers had begun to complain about the oil companies allowing the salt water to run over their farms and into the tile ditches, ruining the land and clogging ditches. So the oil companies piped the salt water back to the oil well and allowed it to flow into the fresh water between the drive pipe and casing. Our wells, by the tests we made at this time, went from 40 parts per million normal up as high as 150 parts per million. At this you could not taste the salt, but it began to look serious, with no law to protect any supply. It did not look very encouraging for us. There was a bill passed in the last legislature protecting the well supply from this contamination, but I understand same was vetoed by Governor Hanly—for what reasons I know not. Even had it not been known that this condition existed, it looks to me, for the benefit of the general public, that too much cannot be done to protect the water supplies of the State of Indiana.

While we were working and investigating all this time for a good supply of water, feeling it for our own interests as well as the public, the Board of Works of our city and the water company came to an agreement that we should build an auxiliary pumping station 3½ miles away on Buck creek, a tributary to White river, draining some 35 miles of area lying south of the city. This station, with pipe lines, was completed in October, 1905. Since that time the public water supply has consisted of deep well water, supplemented by such amounts of filtered Buck creek water as are necessary.

We have in all nine mechanical filters, with a capacity of a little over five million gallons per day. The water from Buck creek plant is pumped to No. 1 plant through two 12-inch cast-iron lines into a settling tank 50 feet in diameter and 20 feet deep, and from here passes through the six concrete filters into the one million gallon concrete reservoir. The well water is all filtered, passing through the iron filters, getting rid of the iron entirely. From here this also goes into the reservoir, well water and creek water being mixed, and so pumped direct from here to city.

THE ENGINEERING WORK OF THE OHIO STATE BOARD OF HEALTH.*

By C. O. Probst, M. D., Secretary, Columbus, Ohio.

THE act creating the Ohio State Board of Health was passed April 14, 1886, and the present secretary came into office on July 28 of that year. The first annual appropriation for the board was $5,000.

In 1893 the board wrote into the health code, while it was pending in the House, this very important addition:

"* * * and no city, village, corporation or person shall introduce a public water supply or system of sewerage, or change or extend any public water supply or outlet of any system of sewerage now in use, unless the proposed source of such water supply or outlet for such sewerage system shall have been submitted to and received the approval of the State Board of Health." This has led to far-reaching results.

In 1898 an engineer was engaged, and gradually an engineering department has been constructed. It now has five engineers and two stenographers.

In the same year a laboratory was established with one man, who was both chemist and bacteriologist. Water and sewage examinations absorbed most of the attention of the laboratory for some years. In 1904 the laboratory was opened to all physicians for diagnostic aid in certain diseases. Stations for mailing equipment were established in every city and every county seat.

The laboratory force now numbers a director, two chemists and two bacteriologists, with a stenographer and janitor. It has been larger at times during special investigations.

In 1897 the board began a systematic investigation of all streams in Ohio. No special appropriation was made for this work, and only a little could be done each year. Mr. Allen Hazen, of New York City, a well-known authority on water supplies, was called in consultation. Under his direction a complete drainage map was made of Ohio. The professors of engineering, bacteriology and chemistry of the Ohio State University were employed to assist us, as we had no laboratory or engineering department at that time. Stations on streams for monthly collection of samples of water were established above and below all towns of any size upon their banks. We could thus know the condition of any stream as it reached the town and the amount of pollution contributed by such town. In addition to such examinations, the engineer carefully inspected the whole watershed and enumerated, as nearly as possible, the sources, character and amounts of pollution reaching each stream.

This work continued five years, and five special reports, of 1,229 pages, were published.

Two years ago the legislature gave the board $15,000 for an investigation of all water and sewage purification plants in Ohio. A detailed study, by engineers specially qualified for such work, has been made of each plant.

This work has been most instructive, and will enable the board to be of much greater assistance in advising municipalities in regard to such plants, and in passing upon plans submitted for approval.

Many interesting questions in water and sewage purification are still unsolved, and the present Legislature has given us an appropriation to continue this work. For instance, the usual methods of purifying sewage in Ohio by the use of septic tanks and subsequent rapid filtration, gives an effluent that will prevent pollution of a stream, but does not remove dangerous bacterial life from the sewage.

Some work has been done and published by the board on the sterilization of such sewage effluents. It is highly probable that where a water supply is taken from a stream a short distance below the sewage outlet of a city above, sterilization of the sewage will be required. This important question will receive further attention.

The extension of the board's work in this direction to limits not now definable, but of great importance to the future of the State, has just been made possible by the enactment of the Bense bill. This act, properly applied, will gradually reclaim our streams and lakes, and give protection against water-borne diseases to all our people making use of surface water supplies. It will enable the State Board of Health to compel any community to purify its sewage, when this is causing stream pollution, or is

*From a paper before the Auglaize County Medical Society.

endangering a public water supply, and also gives it complete supervision and control of all water and sewage purification plants.

It practically removes the debt limit under the Longworth act for such sanitary works. This is a most important provision, as the debt limit has already been reached in many cities, and improvements in sanitation are often the last to receive consideration.

It may be claimed, I think, that with this act, Ohio has taken the lead of any State in the Union as regards protection of water supplies, and is abreast with any other country, not excepting Germany.

The Ohio river, receiving sewage from many States, offers a special problem. We cannot ask Ohio cities to purify their sewage so long as cities in other States pollute it. The board has had introduced in the present General Assembly a joint resolution directing the Governor to appoint a commission of three to act with similar commissions, if appointed, from Pennsylvania, West Virginia, Indiana and Kentucky. The Governors and Legislatures of these States are to be requested to co-operate.

These commissions will recommend to their respective State governments desirable legislation to protect the Ohio river against pollution. Assurances have been given that the Ohio Legislature will adopt the resolution and appropriate $1,000 for the expenses of the commission. (This resolution was adopted.)

Some idea of the work already done in the matter of water and sewage may be had from the board's records, showing that 596 plans for water works and sewerage, and water and sewage purification plants, have been acted upon by the board since 1893, when the board's approval was made necessary.

In each case, with but few exceptions, not only the plans, but the locality, by personal visit, has been given careful study before action was taken.

Some original work has been done in the disposal of trade wastes that has resulted in the suppression of stream pollution and the turning of a worthless, noxious output into a product of some value. This work is still being pursued, but time does not permit of more than this bare mention.

CENTRAL STATION STEAM HEATING.

IN a recent number of *The Central Station* Mr. James A. White gives some results of the operation of the plant of the Citizens' Light, Heat and Power Company, of Johnstown, Pa., which operates a combined plant in which the heating load is at times greater than can be carried by the exhaust steam from the engines operating the electric plant. The following facts are abstracted from the paper to show the methods of construction and operation and the financial results:

In the station are located five engines, as follows:

One 300-h.p. Ball & Wood engine, driving two 100-k.w. generators.

One 200-h.p. Buckeye tandem-compound engine, driving two 60-k.w. Edison bi-polar machines.

One 300-h.p. Buckeye tandem-compound engine, driving two 100-k.w. generators.

One 300-h.p. Buckeye tandem-compound engine, driving three No. 12 Brush arc machines.

One 700-h.p. twin Buckeye engine, direct connected to two 200-k.w. generators.

In the engine room is also located a 200-k.w. rotary converter and a 400-k.w. motor-generator set.

Steam is supplied by 1,750-h.p. in Heine water tube boilers, under which are installed Murphy stokers. The boilers are also equipped with Green fuel economizers and a Pittsburg feed water heater. Worthington feed pumps take water for the boilers from both the city mains and a well on the premises.

This company also operates a power station located on Broad and Tenth streets, known as the Broad street station. This station is not connected to the heating system, due to the fact that it is located too far away from the heating territory. The Broad street station is equipped with two 400-k.w. Westinghouse and one 1,000-k.w. Allis-Chalmers alternating current turbo-generator set, steam being supplied by 1,200-h.p. in Babcock and Wilcox water tube boilers. The rotary converter and motor generator sets at the Vine street station furnish the necessary connecting link to allow the transformation and transfer of current for distribution between the

two stations when such transformation or transfer becomes either necessary or desirable.

The system of underground steam distributing mains is connected to the exhaust piping in the Vine street power house by one 14-inch and one 10-inch main. These underground mains now have a total length of about 13,340 feet, exclusive of service pipes.

Steam heat is supplied to 294 business blocks, residences and public buildings, containing about 15,458,028 cubic feet of space, an average of 1,159 cubic feet per lineal foot of underground main being served. The size of the mains is such that all customers are amply supplied with steam with a back pressure on the engines of only two to five pounds, depending upon the demand.

The station piping is so arranged that the supplemental supply of live steam is automatically delivered to the heating system through reducing valves during those portions of the year when the heating load is greater than can be cared for by the exhaust steam from the engines.

The underground steam mains were installed by the American District Steam Company of Lockport, N. Y., and Chicago, the first installation being placed underground in 1900. The service proved so attractive and satisfactory to both the consumers and operators that several extensive additions have been made, until now there are more than two and one-half miles of mains installed.

Insulation, expansion, anchorage and durability have each to be thoroughly cared for. Durability in the pipe is secured by the use of strictly wrought iron line pipe of full weight. The pipe is carefully wrapped with asbestos paper, held in place by spirally wound copper wire. Between the iron pipe and the wooden insulating casing there is a 1-inch annular air space, the pipe being centered and supported by roller and ball-bearing chains, which allow free expansion and contraction with changes in temperature. The chief insulation is secured by the use of wood casing 4 inches in thickness. This casing is made up of kiln-dried, tongued and grooved white pine staves, carefully selected so as to be free from all imperfections which might affect its durability. The inside of the casing is lined with bright tin and the outside tightly wound with heavy galvanized wire, which is bound on under a pressure sufficient to deeply imbed the wire into the wood. To prevent decay the whole log is covered with a heavy coating of asphaltum and sawdust. Great care is exercised when the mains are installed to drain all seepage and other water away from contact with the steam mains. For this purpose three-ply tar paper is laid on top of the casing to a point below the center line, and a thorough system of underdrainage is secured by placing porous drain tile below the mains and piping same to the sewers at convenient points. The efficiency of the drainage system is greatly increased by placing the tile in sub-trenches filled with broken stone or other porous material. This careful construction results in an insulation against loss of heat so near perfection that condensation in the street mains has been reduced to an average not exceeding 5 per cent. of the total season's output, a showing worthy of comparison with gas and electric transmission losses.

A very ingenious device, known as a "variator," is used for taking care of the expansion and contraction of the piping. This is a case or frame, securely anchored in a brick box, which holds the outer edge of a large annular corrugated copper disk, the inner edge of which is connected to the free end of the pipe. As these expansion devices require no packing or other attention after installation, the street is left free from manholes except at the intersection of streets where valves are placed. The expansion devices are placed about 100 feet apart, with anchorage fittings for holding the stationary end of the pipe placed midway between. Where slight changes in grade are met with, an adjustable double annular wedge is placed between the anchorage fitting and the fixed end of the pipe. All brick boxes inclosing anchorage and expansion devices are filled with white pine or other soft wood shavings to prevent radiation of the heat.

All service pipes to buildings are taken from anchorage fittings and the stationary part of the expansion devices, from openings placed above the top of the main pipe, thus securing a separator effect and insuring the delivery of dry steam to the customers. The wood casing is used for insulation on all service pipes. Flanged cross fittings are placed at the intersections of all streets, so that extensions to the system may be made when the business to be secured so justifies. These fittings are made eccentric to secure the thorough drainage of water of the condensation to the low points on the

system, where traps are placed for its removal.

Valves are placed in manholes at the street crossings, so that only small sections of territory are affected when it becomes necessary to make connections for new customers after the steam is turned on the system. The manholes have a specially constructed double cover, the inner one being provided with a ring of packing which prevents all surface water from the street coming in contact with the steam pipes. Owing to the many difficulties encountered in underground construction in city streets, as well as the many points relating more especially to the laying of steam mains which are only learned through experience, it becomes necessary, when installing underground steam mains, to employ experienced engineers who have specialized this particular branch of work in order that the success of the system from a mechanical and maintenance standpoint may be assured.

The total kilowatt hours output of the Vine street station in 26 months amounted to 6,856,950, of which 5,252,347 kilowatts were produced during the eighteen heating months.

The total cost of all fuel, water and boiler house labor during the twenty-six months amounted to $52,138.77, the cost during the eighteen heating months amounting to $40,971.17.

The income from exhaust and live steam sold during the twenty-six months amounted to $62,962.64, and during the eighteen heating months, $60,721.92.

The significance of these figures should be very carefully noted by central station managers. The receipts from steam furnished for heating purposes during the eighteen months of the heating season paid for all fuel, water and boiler house labor and left a surplus of $19,750.40. While this surplus was being earned there was also produced 5,252,347 k.w. hours from the same fuel, water and boiler house labor. These results are all the more interesting in view of the fact that the rates charged for steam heat at Johnstown average the lowest on record. All steam is sold by weight on the meter basis of charging, which prevents loss to the station operator through waste by the consumer. The condensation from the radiation in each building is collected, and after passing through a trap and economy coil, which latter utilizes for heating purposes the heat remaining in the water of condensation, the water is weighed in a Simplex condensation meter, which registers on a dial every pound of water passed.

Although there is always a greater or less amount of live steam required to supplement the supply of exhaust from the engine during the heating months, the increase in fuel consumed for heating and generating electricity over the fuel required for generating electricity alone during the non-heating months is less than 20 per cent. per kilowatt hour.

A study of the figures for corresponding months reveals a relation of great value between the kilowatt output and the amount of coal burned in those months during which the heating load exceeds the electrical load. This relation shows that with an increase in the kilowatt output, during the months in which the steam requirements for the heating load are greater than the steam requirements for the electrical load, there is a general decrease in the total amount of coal burned, and this in general continues true when the quantity of coal is modified for the factor of evaporation. As far as the author is able to ascertain, this same relation is found in all heating plants where the heating load is greater than the electrical load. These facts would indicate that as the power output is increased up to the point where the heating load is entirely cared for by the exhaust steam, the consumption of coal will be reduced.

Much credit for the good showing from this plant is due to careful management and operation, as well as the constant comparison and study given to carefully kept records.

The results obtained from this combination plant are such that the seeming advantage of power house sites placed away from the thickly built-up sections of our towns and cities for the sake of cheap land, condensing water or facility in the handling of coal, entirely disappear, as does also the advantage of the gas engine, with its much-vaunted thermal efficiency, and engineers, in designing plants, should look carefully into the advantages of such combination systems before making expenditures for power installations in locations where such a distribution of the unused heat cannot be made.

PRINCIPLES UNDERLYING A STREET LIGHTING CONTRACT.

A COMMITTEE of the Civic League of St. Louis has been studying the question of street lighting in preparation for its letting of a new contract in the year 1910. The chairman of the committee is Prof. J. L. Van Ornum, head of the civil engineering department of Washington University, and the committee includes the head of the electrical engineering department of the University, a former city comptroller, a member of a manufacturing firm, an attorney, and a mechanical engineer.

The committee has made a careful and thorough study of the engineering, financial and political questions involved and has published in a 44-page pamphlet the report thereon. This report gives the arguments on which the following conclusions are based and is discussed in some of its phases in the editorial department, the conclusions being given here as on the whole stated fully enough to indicate definitely the course of reasoning followed by the committee and the route through which they were led by the facts developed:

I. The present contracts for street lighting expire August 31, 1910.

II. Definite arrangements for the lighting of the streets should be made far enough in advance of that date to secure the best system of lighting and insure the best terms to the city.

III. The committee believes that for the present at least the residential section of the city should be lighted by gas and the business section by electricity.

IV. The present cost of electricity of $97.50 per arc lamp per year and $16.65 per incandescent lamp per year, and of gas at approximately $27.00 per mantle lamp per year, is unreasonably high and should be materially reduced.

V. Three possible ways of securing a reduction in the cost ol electricity.

A. By constructing a municipal plant.

B. By encouraging competition.

C. By regulating and controlling prices.

A. A Municipal Plant:

1. The total cost of operating a municipal plant, if operated in a business like manner, would be approximately 2½ cents per kilowatt hour, or about $69.000 per arc lamp per year, and about $17.00 per incandescent lamp per year.

2. But the danger of partisan politics in the management and operation of the plant, which tends to reduce its efficiency and increase its cost, indicates the inadvisability of municipal ownership except as a last resort.

3. Municipal ownership in the place of public franchise grants merely transfers the danger of political mismanagement from the legislative body, which grants the franchise, to the administrative officials appointed by the legislative body to operate the plant.

4. The economy of municipal operation and control has not yet been proven in this country—only two of the first ten cities, Chicago and Detroit, have attempted it. The experience of these two cities is not such as to warrant the statement that a municipal plant would be more economical than contract lighting.

5. In the opinion of the commission the conditions at the present time are unfavorable for the construction and operation of a municipal electric lighting plant for the lighting of the streets of the city; and it believes this function should not be undertaken by the municipality if reasonable rates and efficient service can be secured from private companies. However, the city should reserve the right to construct its own plant.

B. Competition:

1. The duplication of investment and equipment, the damage to the pavement, and the injury to the appearance of the city, make competition wasteful, ultimately add to the price paid by the consumer, and finally induce public lighting corporations to merge.

2. The company which supplies commercial lighting can supply public lighting at a minimum cost to the city, because:

(a) Every increase in the demand for service means a decrease in the cost of production.

(b) An electrical plant, primarily for street lighting, cannot be operated economically since its daily output is small and it is under full load for less than half the time. A commercial plant is under a more nearly uniform load during the twenty-four hours of the day.

(c) A private company can take immediate advantage of inventions and improvements for reducing the cost of production. Municipal plants, as is shown by experience, seldom keep pace with modern and improved methods.

3. Your committee is of the opinion that a resort to competition, while it might assist in reducing exorbitant rates temporarily, is only a makeshift; and that permanently satisfactory results and a minimum cost for lighting cannot be secured by competition.

C. Regulation and Control of Existing and Future Companies:

1. The Enabling Act of 1907 gives the city full power and authority to fix and determine a reasonable rate both for gas and electricity, and to provide and enforce fines for the violation thereof.

2. A public utilities commission, composed of competent and trustworthy business and technical men, should be provided immediately by ordinance, with such powers as are prescribed by the Enabling Act.

VI. Payment for electricity and gas should be based upon metered service —the maximum cost per lamp per year being fixed by ordinance.

VII. No contract should be made for gas or electric lighting covering a long period of years, and it should contain provisions for frequent readjustment of rates and a clause enabling the city, at intervals, to require the substitution of new and more efficient styles of lamps. Only in this way can the public reap the advantage of the rapid reduction being made in the cost of gas and electric light as a result of new inventions and improvements.

VIII. A uniform system of efficient and ornamental lighting should be established, especially for the business streets, of the city.

(a) In the business portion electroliers or arc lamps of uniform style should be adopted and so spaced as to brilliantly illuminate the streets by night and make them attractive by day.

(b) In the residential portion it may be deemed advisable to supplement the present gas lights with arc lights at street intersections in order to secure adequate illumination.

IX. In all of the conclusions reached the committee is unanimously of the opinion that a definite and reasonable regulation and control of prices and service, determined by a public utilities commission, permanently established by ordinance under recent statute, is fundamentally essential.

LAUREL RUN DAM, NEAR HAGERSTOWN, MD.

EDITORIAL COMMENT

Regulation of Height of Buildings.

A Study of Steel Columns and Struts.

Control of Public Service Corporations.

REGULATION OF HEIGHT OF BUILDINGS.

New York, Philadelphia and Chicago have been seriously discussing the regulation of heights of buildings and their areas in proportion to the areas of their lots and their heights. Mr. D. K. Boyd, the president of the Philadelphia chapter of the American Institute of Architects, has recently offered a contribution to the discussion which introduces some new ideas.

The New York proposition is to limit the height of a building erected on the lot line to 100 feet, and greater heights are permitted, provided the cornice line does not intersect a line drawn at an angle of 60 degrees with the horizontal, perpendicular to the curb line, and passing through a point on the plane of the lot line 100 feet above the curb. If the cornice line is more than 30 feet back of the street line of the lot, this restriction does not apply. This regulation would practically make a cornice line on the lot line at a uniform height of 100 feet above the curb, higher buildings having extensions above this line offset 30 feet or more back of the lot line, with possibly a second offset from this 30-foot line at a height a little over 150 feet above the sidewalk. To the passer on the street below, therefore, there would be a street facade with a uniform cornice line and the observer on the opposite sidewalk could see the higher portions of buildings projecting up from behind this cornice line. This uniformity of height of buildings on the line between lot and street seems to be what such cities as Paris and Berlin are striving for, and Paris even prescribes to a certain extent the architectural features of the facade other than the height.

Mr. Boyd has suggested the application to a business street of a regulation intended for boulevards, whereby the height of a building is limited by a line drawn perpendicular to the curb line from a point thereon through a corresponding point on the plane of the lot line and above the curb a distance equal to 1¼ times the width of the street, and is, say, 75 feet on a 60-foot street. If the owner wishes to erect a taller building than this would permit, he must set his building back so that all of its front will lie below the diagonal line above described, at the point where this line intersects the plane of the front. This regulation, Mr. Boyd says, was proposed for a great diagonal boulevard on which the buildings would be largely public or monumental in character, and usually wholly detached, and it would evidently be of great value in introducing variety in building lines as well as elevations, and would give greater opportunity for individuality in the treatment of the buildings in mass and on facades.

In applying the same regulation to business blocks on comparatively narrow streets, a great departure will be made from the uniformity in line and height which is so highly praised by some as it has been developed in Paris. If carried to its limit, there would be no uniformity in alignment of buildings, for not only would the sky-line be broken, as it is at present, but the ground line would be broken also. Mr. Boyd himself calls attention to the recesses and angles which would be formed at the sidewalk level, which would require better street lighting to prevent loitering at night in the dark corners, an improvement of which American cities are sadly in need. He suggests grass plats and

fountains or that the shops on the ground floor be brought out to the sidewalk line.

From the points of view of sanitation and safety, the regulation of the proportion of area of building to lot is quite as important as that of the relation of height to area of lot and street width. The proposed New York ordinance provides for an increase in area of courts or areaways in proportion to increase in height, the percentage of area to be left for light and air for buildings less than 185 feet high to be determined by dividing twice the square of the elevation above the curb by 1,000, with a minimum of 10 per cent. There will apparently arise in tall buildings on restricted space between other buildings a conflict between the provision requiring the setting back of the front of the taller part of the building, and the provision of areaways or courts to furnish light and air to the building below the limit of height on the street front.

One of the most objectionable features of the ordinary tall building is the bald appearance of the sides which are adjacent to other lots and are supposed to be concealed by the construction of similar buildings on those lots. This is a problem in aesthetics which has not had much discussion, but those who have made the most radical departures in the way of tall buildings, such as the Singer Company, the Metropolitan, and now the Equitable Life Insurance Company, have very properly assumed the improbability of equal structures adjoining them, and, aided by the conditions on their lots, have so located the towers and developed their architectural features that they will be unobjectionable on this account.

Their success suggests a building regulation which will insure similar treatment of all tall buildings. The interference of the regulations proposed for the purpose of giving light and air to the streets, with those requiring provision for light and air in the buildings themselves, will demand modifications of one or the other. It is suggested that, if the building is located in the center of the lot, with a large proportion of the court area outside the building rather than surrounded by it, the combination of the two would give better light and air for both buildings and streets. It might be necessary to leave ventilation shafts within the building, or, in case of very large buildings, areaways or courts also. But in the case of buildings of smaller area the same floor space might be so arranged as to give all offices outside exposures. Under Mr. Boyd's plan the space next the street would be fixed and the areaway or court spaces could be distributed around the other two sides of the building. When the corresponding space for the adjoining buildings is similarly disposed of, possibly the space between buildings will be all that is necessary for light and air. If not, something can be borrowed from the space next the street. Or, if the area between buildings is still too small, a provision might be adopted whereby buildings of more than a certain definite height which the above requirements would fit, should be constructed only on lots of certain large area or lots with streets on at least two sides. If commercial considerations prevail, the first story of the building might cover all the space, or grass, flowers, fountains, walks and seats can be used to beautify it.

This is another suggestion in the line of those already made. The subject is one of the utmost importance, even in what may be termed the smaller cities, and is pressing for proper treatment. The problem must be solved first by the building departments for the large cities, and they must have the support, and to a considerable extent the direction, of the public. Therefore, general discussion is necessary and is invited by the building departments and by the architects and engineers, who are not satisfied to work under the very serious limitations imposed by present conditions, and are therefore not satisfied with either the artistic or sanitary results.

A STUDY OF STEEL COLUMNS AND STRUTS.

The collapse of the Quebec bridge while under construction is now generally conceded to have happened because the designers had passed beyond the limits of our experimental knowledge in providing the mammoth compression members demanded by the computed stresses. A minor defect in a member concentrated the stress upon too small an area and its collapse occurred, followed by the collapse of the erected portion of the span.

Various testing laboratories throughout the country have begun series of tests which are intended to throw light upon the dark areas in our knowledge of the subject. The Watertown Arsenal testing laboratory of the U. S. army, in particular, has inaugurated such a series, which promises to be upon an adequate scale.

There is no central governing body of any sort to direct these tests or to co-ordinate and compare them, and the public looks to such an organization as the American Society of Civil Engineers for guidance in a matter so strictly engineering in its character as this. The Board of Direction of the society has recognized this fact, and in accordance with a resolution adopted at the March 4 meeting of the society has recommended that such a committee be appointed. This action was approved at the June convention of the society, and the required letter ballot of the membership was ordered.

The arguments against the appointment of the committee which have been offered are based on the statements that investigations, to be of value, must be extensive, and the necessary tests will be too expensive for the society to enter upon, and also that the directors of such experiments should be well paid for the large amount of their time which they should put into the work. These points would be well taken if it were the intention of the society to enter upon this side of the investigation. The original resolution called for a committee "to investigate steel columns and streets, and to report upon their design, ultimate strength and safe working values." The facts above stated regarding tests and experiments under way, and the limitations in the power of the society, led the Board of Direction to restrict the definition of the word "investigate," and its duties will be to discuss the results which are secured from time to time by others, to make suggestions as to methods of procedure, to collate and compare the reports of work done —in short, to act as an independent advisory and assisting body, ready to fill in all gaps which may appear in the line of advance and put the resulting facts into their true scientific and practical engineering relations. The society cannot afford to disappoint public expectation by refusing to perform this arduous labor, which will not be directly remunerative to either the individuals on the committee or to the society, but will nevertheless be well worth while for all concerned.

One-third of the membership must vote for the resolution, and there is no doubt that many more will vote promptly on receipt of the form of letter ballot, so that the committee can be appointed in the early autumn.

CONTROL OF PUBLIC SERVICE CORPORATIONS.

Elsewhere in this number will be found a statement of the conclusions reached by the committee on street lighting of the Civic League of St. Louis, based on its study of the question of the nature of the new contract for such service which the city must make in 1910. The report speaks in no uncertain terms and recommends the letting of a contract to a corporation containing provisions for full control of rates for and quality of service.

This conclusion seems to rest largely on the report of the National Civic Federation Committee, with collateral evidence from Syracuse, Rochester, Detroit and Chicago. This report gives the best brief but comprehensive analysis of the financial results of the Chicago plant which has yet appeared. The total cost of the plant is comput-

ed, also depreciation, taxes, insurance, water, rent, salaries, wages, etc., for each year. A tabulation shows the total cost of operation each year including all the above items, the number of lamps (increasing from 192 in 1888, to 5,743 in 1905), the cost per lamp for operation and the cost per lamp for operation and interest on investment at 4 per cent. compound interest on the capital invested. The number of lamps rented from private corporations for each year from 1890 (93) to 1905 (643), and the price paid per lamp per year are also given. From these tables the following table is derived:

RELATIVE COST OF PUBLIC AND PRIVATE LIGHT IN CHICAGO.

Year	Total cost per lamp per year, municipal plant, including everything.	Average price paid for lamps rented from private corporations.	Saving in city plant per lamp, per year.
1890	$155.19	$177.95	$22.76
1891	207.28	174.33	—32.95
1892	192.17	174.63	—17.54
1893	196.17	155.62	—41.35
1894	194.06	137.38	—56.68
1895	205.86	193.38	—102.48
1896	188.39	113.28	—75.11
1897	156.99	113.23	—43.76
1898	142.76	109.10	—33.66
1899	109.04	103.28	—5.76
1900	112.53	102.84	—9.69
1901	101.24	101.58	0.34
1902	99.28	102.66	3.38
1903	98.78	102.82	4.04
1904	106.45	102.92	—3.53
1905	100.06	102.52	2.46

The negative sign in the table denotes loss or excess of cost in the municipal plant over rented lights. The total loss during the period was $164,921.96, or an average of $3.86 per lamp per year.

The committee does not hold strenuously to the charge of 4 per cent. compound interest, but gives also the totals assuming the charge of 4 per cent. simple interest on the capital invested. On this basis the city gained $7,014.75 by the municipal operation of the plant during the period, or $0.17 per lamp per year. Many will consider this to be a more equitable charge than that of compound interest. Either figure indicates the practical success of the Chicago municipal plant. Moreover, the column of prices paid for lights rented from private companies shows a vastly greater saving to the city than the above comparison would indicate. A reduction in price of $75 per lamp per year in 15 years on an average of nearly 3,000 lamps per year amounts to some $200,000. While some of this reduction could have been secured in any event, a large part of it is an unquestionable saving to the city, probably enough to wipe out the deficit under the assumption of compound interest, not to speak of the saving to private customers of the private plants, whose rates have been reduced at the same time and as a consequence but probably not to the same amount.

The city of St. Louis had a cleaning up a few years ago and the committee apparently assumes that graft is cut out of the city government, at least it omits from its consideration of the problem the chances for the exercise of undue influence upon the rate raising body in the city government. The experience of St. Louis itself demonstrates that this opportunity may result in greater loss to the city, not to speak of the effect upon the morals of the community, than might come from much worse management of a municipal plant than that found in Chicago and Detroit. This is a serious omission from a report which considers, on the other hand, the effect of political management upon the efficiency and economy of a municipal plant, for the omitted factor may be and probably is a stronger one in controlling the real economy of the service to the city.

Such control of rates as is proposed for St. Louis lighting should include rates for private service and should be removed as far as possible from the influence of local conditions Under our form of government the greatest distance can be secured by putting such matter in the hands of a state commission, the appointment of the members of which is safeguarded by

provisions which will insure as thoroughly as possible expertness, honesty and efficiency. Such a commission should be supported by the most important factor in securing honesty and efficiency in management of the corporations interested, publicity of reports, secured by giving the commission the duty and power to require detailed statements of operations in form for publication in periodical reports. Control of rates also requires control of issues of capital. The control of rates may be made automatic if the other factors are properly taken care of. Practical experience in this country as well as in others, notably in England, has demonstrated the value of this form of control of public service corporations.

While the report of the committee is upon the problem in St. Louis, a discussion of the best method of exercising the desired control of the corporations would not be out of place, for the St. Louis problem will not reach its fullest and most satisfactory development until the best form of controlling body possible has been formed.

THE QUESTION DEPARTMENT

Steel Protection for Concrete Curbing.

Are you in a position to know whether the cement contractors in all cities are expected to put in steel plates for protection at all corner and alley intersections? City authorities here make them do it. A. W. D., ———, O.

This is a matter of specification by the city engineer, board of public works, or other body having the construction of public works in charge. There are several methods of protecting and reinforcing curb now on the market, the names of companies being given in the "Business Directory" printed in each number of MUNICIPAL ENGINEERING under the headings "Combined Curb and Gutter," "Concrete Edge Protector," "Curbing." There is doubtless room in the market for others, as there is an increasing recognition of the necessity of protecting curb from wear where wagon wheels are liable to rub against it, as on street and alley corners and where wagons stop to take on and put off heavy loads. If the requirement of this protection is not already in a city's specifications, it ought to be possible by proper representations to the authorities to have it inserted, particularly for the business streets and main lines of travel away from the business center.

The Concrete Association of America.

A German correspondent wishing a list of the members of the Concrete Association of America is referred to Ross F. Tucker, the president of the association. The association is composed of those who are desirous of encouraging and developing the intelligent and scientific use of concrete and standardizing methods of construction, mainly New York contractors. It sustains a free permanent exhibition on the eleventh floor of the Brunswick Building, Fifth avenue, Twenty-sixth and Twenty-seventh streets, New York City, where the association and its officers may be addressed.

Concrete Sewer Pipe.

Kindly give me any information you have in regard to use of cement tile in sanitary drainage sewer. Kindly refer me to cities or towns using same successfully. R. C. H., Lincoln, Neb.

On page 358 of the June number of MUNICIPAL ENGINEERING will be found a full list of the articles which have appeared in this magazine on the subject of concrete or cement pipe for sewers, which is supplementary to a list in vol. xxxiii, p. 407. See also page 31 of the July number, where a list of books giving information on the subject and of cities in which concrete sewers are used will be found. To this list may be added Brooklyn, N. Y., Washington, D. C., Cleveland, O., Jackson, Mich., Reading, Pa., Salt Lake City, Utah, Coldwater, Mich., San Antonio, Tex., Toledo, O., Columbus, O., whose work is described in this magazine, and many others, as concrete sewers are now quite popular, and many cities, large and small, use them.

The only serious objection to the use of concrete in sewers has come recently

from Great Falls, Mont., where, it is claimed by the chemists who have investigated the case, the alkali in the soil, composed of sodium and magnesium sulphates and smaller quantities of calcium and potassium sulphates, and sodium chloride and carbonate, has a detrimental action on the cement in mortar and concrete, so serious that the sewers are disintegrating rapidly from the destruction of the concrete and also of the cement mortar in brick work. This action is attributed to the alkali in the soil, and it is definitely stated that the sewage has no detrimental effect on the concrete. An article on the subject will be found elsewhere in this number of MUNICIPAL ENGINEERING.

Action of Sewage on Cement Pipe.

We will shortly begin the laying of about eighteen miles of sewers and have about decided to use cement pipe, but have recently been informed that the sewage causes the cement pipe to disintegrate in a few years. Can you get us up some data on this matter?

C. W. HAYES,
Member of Special Committee on Sewerage Construction,
Fitzgerald, Ga.

Our correspondent is referred to the article in this department under the title, "Concrete Sewer Pipe," and also to the article on "Durability of Cement and Concrete in Sewers."

Cement Stucco for Residence Construction.

Kindly inform me where I may obtain the very best information and instruction in regard to stucco on metal lath for residence construction, and if you believe it would be satisfactory in this climate.

C. O. T., Sullivan, Ind.

Portland cement stucco, properly applied, is very durable, and its use for veneering both old and new buildings is rapidly increasing. The Atlas Portland Cement Company's booklet on "Concrete Construction About the Home and on the Farm" gives the following instructions for making the mixture and applying it:

"As a rule, two coats are used, the first a scratch coat composed of 5 parts Portland cement, 12 parts clean, coarse sand, 3 parts lime and a small quantity of hair; the second a finishing coat composed of 1 part Portland cement, 3 parts clean, coarse sand, and 1 part slaked lime paste. Should only one coat be desired, the finishing coat is used. Some masons prefer a mortar in which no lime is used, but this requires more time to apply.

"In applying stucco to brick or stone structures, clean the surface of the wall, and, after thoroughly wetting, plaster 1½ inches thick. For a finish either smooth with a wooden float or rough by rubbing with burlap.

"In using stucco on a frame structure first cover surface with two thicknesses of roofing paper. Next put on furring strips about one foot apart, and on these fasten wire lathing. Apply the scratch coat ½ inch thick and press it partly through the openings in the lath, roughing the surface with a stick or trowel. Allow this to set well and apply the finishing coat ½ inch to 1 inch thick. This coat can be put on and smoothed with a wooden float, or it can be thrown on with a trowel or large, stiff-fibered brush, if a spatter-dash finish is desired. A pebble-dash finish may be obtained with a final coat of 1 part Portland cement, 3 parts coarse sand, and pebbles not over ¼ inch in diameter thrown on with a trowel."

See also the article on "Band Stand for Park" on page 112.

Concrete Silo Building.

I would like to receive information in regard to silo building. I have one to build, 30 feet in diameter, 58 feet high.

J. D. B., Cedar Rapids, Ia.

A silo is simply a concrete tank which is not subject to as much strain as one to carry water, and which can therefore be made somewhat lighter. The following specifications are abstracted from those for a silo with hollow walls given in the Atlas Portland Cement Company's booklet on "Concrete Construction About the Home and On the Farm." The diameter and height are not given and no limit is set to either in the specifications.

The excavation is made to a level below frost and to the outside diameter of the silo. A 16-inch solid concrete wall is laid to line this excavation to the level of the ground, the concrete being 1 part Portland cement, 2½ parts clean, coarse sand, and 5 parts of broken stone. The space inside the wall is filled within 8 inches of the ground level with cinders, gravel or broken stone, tamped hard. The portion of the inside of the concrete wall which shows is then picked with a stone-ax and thoroughly wet, the filling is also wet, and the space is then filled with well-tamped concrete within one inch of the top of the foundation wall, and leveled off, forming a floor for the silo. The concrete in this floor is the same as that for the foundation wall.

Forms are then erected 4 feet high for hollow walls, with 3-inch thickness of concrete, front and back, and 10-inch air chambers or hollows, with piers of concrete connecting the two 3-inch walls, these piers being also 3 inches thick. Instructions for building these forms are given in the booklet referred to. The vertical reinforcement consists of ½-inch twisted steel bars placed vertically around the circumference of the outside wall about every 3 feet, at the intersections of outside wall with the connecting piers. It is placed in the forms and held securely in place by wooden blocks or wire ties. These rods run up full length, and if not long enough to reach the top should break joint. The horizontal reinforcement consists of ⅜-inch steel hoops running entirely around the silo and buried in the concrete. They are spaced vertically 1

foot apart. After the reinforcing is placed the form is filled with concrete mixed rather wet and thoroughly tamped. This concrete is made of 1 part Portland cement, 2 parts clean, coarse sand and 4 parts broken stone.

After the cement is set hard, the top of the wall is cleaned with a stiff wire brush, is wet thoroughly and the forms are raised for the next filling. The raised forms should overlap the walls already built by about 2 inches, which will tend to keep the walls plumb. Continue raising and filling the forms until the desired height is obtained. Each filling should be completed the same day, so that the rate of progress will be the height of the form each day, unless two or more forms are used.

To prevent moisture soaking through, the outside may be washed with a coat of neat cement mixed as thick as cream and applied with a brush, or a spatter-dash finish may be put on. The inside should be plastered ¼ to ½ inch thick with mortar of 1 part Portland cement and 1 part clean, coarse sand. Before applying this plaster the wall should be picked with a stone-axe and thoroughly wet.

Openings for doors should be left about every 3 feet on one side of the silo for convenience in handling the ensilage, and a chute running the full height of the silo should be built around these doors, say 2½ feet on the sides and 4 feet wide, along the face of the wall. Two or more doors may be left in the outside of this chute also. The walls of the chute should be 4 inches thick and reinforced with vertical twisted iron bars. It should be built up with the silo wall and monolithic with it.

The same booklet describes two solid concrete wall silos, 20 feet in diameter and 32 feet high. The walls are 12 inches thick. In this case the concrete was made of 1 part Portland cement, 2 parts clean, coarse sand, 3 parts clean, fine gravel, 4 parts clean, broken stone, hard-burned brick or terra cotta, broken to pass a 2-inch ring. Good clean cinders, free from unburned coal, may take the place of the stone.

Forms are made about 5 feet long and 4 feet high, of 2 by 12-inch joist, sawed to the outside diameter of the silo. The inside piece sawed off can be used for the inside form of the silo wall. These circular braces are fastened together and serve to hold the lagging for the form. In laying an upper lift upon the wall already laid, a cement grouting, 1 part Portland cement and 1 part sand, was used to aid in joining the old work with the new.

In this case the chute was made of 12-inch terra cotta pipe set in concrete on the inside of the wall and continuous with it. This chute had 12-inch T's on the inside every 4 feet and a flaring opening at its bottom on the outside of the wall at a convenient height for delivering the ensilage into carts. The T's are covered with terra cotta plugs while filling the silo, the plugs being removed as the ensilage is removed, and they come into convenient location for use.

A shingle roof was used on this silo, anchored to anchor bolts set in the top of the wall during construction, with a galvanized iron ventilator at the apex.

The inside was plastered with mortar of 2 parts Portland cement and 3 parts sand, and the outside was given a pebble-dash finish.

The bottom of this silo was similar to that of the first one described, but was set below the surface of the ground without the foundation wall.

Gillette and Hill's "Concrete Construction Methods and Cost" ($5) gives the dimensions of a silo 28 feet high, 22 feet 3 inches inside diameter and 6-inch thickness of walls. The bottom of this silo was 9 inches thick and set 2 feet below the surface. The reinforcement in the lower half was 10 iron hoops from an old wooden silo, each 2½ by 3-16 inch, spaced equally, and in the upper half was woven-wire fencing. The concrete was made of 1 part Portland cement and 6 parts of a sandy gravel. Four-foot sections were made, one each day, the concrete being deposited in the afternoon and the form moved up the following forenoon. Farm labor was used mainly, the equivalent of 100 days of such labor for one man being required, with seven days of a mason brushing and troweling the surface at double the wages, his pay being $3.50 a day.

The descriptions of tank construction given in Buel and Hill's "Reinforced Concrete" ($5) will be of interest in this connection, also.

White Portland Cement.

Is there a brand of good white Portland cement on the market, one that will finish white and stand the weather?

A. F., Brookville, Ind.

The Sandusky Portland Cement Co., Sandusky, O., has a brand of white cement which is a true Portland cement, and will therefore stand the weather. It is understood that it is non-staining on account of its white color. The Art Portland Cement Co., Kimmell, Ind., has the Parthenon brand of Portland cement, which is also white and non-staining and will stand the weather, and the Perfection brand, which is a stainless Portland cement, very nearly white in color, and will stand the weather. Meacham & Wright, Chicago, Ill., advertise the Blanc brand of stainless cement as a true Portland cement. It is white and stainless. There are one or two other brands on the market making similar claims, but the information concerning them is rather meager.

Reinforced Concrete in Building and Its Failures.

Kindly give us references to articles in MUNICIPAL ENGINEERING on the use of re-

inforced concrete in building construction, and the failures attending the same.
THE RIGGS & SHERMAN CO., Toledo, O.

Following are the most important articles on these subjects which have appeared during the past four years:

In vol. xxxv: "A Reinforced Concrete Standpipe," p. 5; "Tests of Reinforced Concrete Columns," p. 53.

In vol. xxxiv: "Artistic Treatment of Reinforced Concrete," p. 2; "Proposed Building Ordinance Governing Reinforced Concrete," p. 67; "Methods and Costs of Concrete Construction with Separately Molded Members," p. 74; "Systems of Reinforced Concrete Construction," p. 77; "Protecting and Reinforcing the Wearing Surfaces of Concrete Curbing," p. 120; "The Collapse of the Lawrence, Mass., Filter Roof During Construction," p. 138; "Sufficiency of Concrete Arch Design," p. 167; "Protecting Concrete Curb," p. 188; 'Continuity of Reinforcement in Reinforced Concrete Structures," p. 217; "Reinforced Concrete Lining for Reservoir," p. 238; "Design for Concrete Arch," p. 240; "Reinforced Concrete in the Construction of Highway Bridges and Culverts," p. 277; "Method of Making Concrete Poles," p. 302.

In vol. xxxiii: "Cement Post Problems," p. 253; "Electrolytic Corrosion of Iron and Steel in Reinforced Concrete," p. 296; "Reinforced Concrete Floor," p. 340; "Reinforced Concrete Posts," p. 344; "A Hanging Concrete Stairway," p. 418.

In vol. xxxii: "Cost of Reinforced Concrete Building Construction," p. 1; "A Puzzle in Reinforced Concrete," p. 16; "Architectural Form and Finish in Concrete Construction," p. 24; "Ordinance to Regulate Concrete Building Construction in San Francisco," p. 25; "Ordinance to Regulate Concrete Construction in Pittsfield, Mass.," p. 31; "Recent Failures of Reinforced Concrete," p. 80; "Reinforced Concrete Pipe," p. 86; "Reinforced Concrete Tower and Floors," p. 87; "Forms of Concrete Construction," p. 109; "Foundation Problems in New York City," p. 150; "Building Regulations for Concrete," p. 162; "Tests of Reinforced Concrete Beams," p. 236; "Forms for Reinforced Concrete Grain Bins," p. 249; "Reinforced Concrete Conduits," p. 317; "Summary of Results of Tests of Concrete Columns and Beams," p. 396.

In vol. xxxi: "Reinforced Concrete Bridge on East Washington Street, Indianapolis, Ind.," p. 1; "Builders of Reinforced Concrete Houses," p. 24; "Reinforced Concrete," p. 107; "Reinforced Concrete Pipe," p. 166; "Building Materials in the San Francisco Earthquake," p. 170; "The Progress and Logical Design of Reinforced Concrete," p. 196; "Cost Reduction of Reinforced Concrete Work," p. 218; "Cost of Reinforced Concrete Floors," p. 277; "Concrete Tanks and Silos," p. 277; "Conclusions from the San Francisco Conflagration," p. 283; "Systems of Steel Reinforcement of Concrete," p. 399; "Provisions Regarding Cement Construction in Grand Rapids," p. 472; "Expert Supervision of Building with Reinforced Concrete Necessary," p. 475.

In vol. xxx: "Fire Test of Reinforced Concrete," p. 1; "Steel for Reinforcement," p. 92; "Cement and Building Construction," p. 95; "Corrugated Concrete Piles," p. 190; "Formulae for Strength of Concrete Beams," p. 348; "Breaking Strength Formulae for Concrete Beams," p. 357; "Reinforced Concrete Withstands Earthquake and Fire," p. 375; "The Possibilities of Concrete Construction from the Standpoint of Utility and Art," p. 440; "A Trussed Concrete Post," p. 463.

In vol. xxix: "The Strength of Reinforced Concrete," p. 167; "Breaking Strength Formulae for Concrete Beams," p. 347; "Experiments on Steel-Concrete Pipes," p. 353; "Machine for Making Steel-Concrete Fence Posts," p. 381; "Concrete Construction According to Minneapolis Building Ordinance," p. 441.

In vol. xxviii: "A Skew-Arch of Concrete-Steel," p. 7; "Report of Committee on Materials of Construction to Indiana Engineering Society," p. 116; "Cement Posts," p. 144; "Aims and Scope of Laboratory Tests of Reinforced Concrete," p. 248; "Cement Posts," p. 329; "Test of Reinforced Concrete Floor Slabs, Beams and Girders at Frankford, Pa.," p. 401; "A Reinforced Concrete Reservoir Dam," p. 438; "Reinforced Concrete Arches," p. 442; "Concrete-Steel Water Tank," p. 450.

In vol. xxvii: "Concrete-Steel for Building Construction," p. 28; "Concrete-Steel Bridges at Dayton, O.," p. 83; "The Thebes Bridge Over the Mississippi River," p. 90; "A Steel-Concrete Building," p. 166; "Fire Test of Concrete-Steel Building Construction," p. 213; "Reinforced Concrete Sewers in Wilmington, Del.," p. 248; "Strength of Reinforced Concrete Beams," p. 414; "Concrete and Concrete-Steel in the United States," p. 441.

Problems in Street Paving and Drainage.

1. Is it practical and very necessary to put in a sewer tile 4 inches under the curbstone where land is not swampy? Where should it be placed, right under the curb or outside of the bottom of the curb in broken stone?

2. Would it be advisable to put the surface water from paved streets in the main sewer or let the surface water drain run under the paving and come out on other cross streets? About what depth should it be buried under the pavement?

3. What kind of paving would you advise—gravel, broken stone or concrete, say 5 inches thick? What proportions do you advise to mix the concrete and about how much time should it lie before traveling on it?

4. Would you use any good cement for concrete, and how would you generally test the different cements?

5. Where can I find specifications regarding paving, giving a fair explanation of the same?

6. What difference in elevation would

you advise to make between curbstones on a street, say, about 34 feet wide?

M. J. D., Kane, Pa.

1. The drain under the curb is intended to carry away any water which would otherwise collect under the pavement, whether this water comes from the surface or from the subsoil. If the trench in which the curb and the drain are laid is filled with broken stone the drain may be under or outside the curb. If the drain is under the curb, the trench must be deep enough so that the weight of the curb on the broken stone over the drain will not break the drain pipes. If the drain is outside the curb, the trench must be widened to take it, and this will cost a little extra labor and material. The drain should be laid deep enough to lower the ground water below reach of frost. If there is no ground water and the surface water is drained off so that it will not reach the pavement foundation, there is no need of the drain under the curb; nor is any needed if the soil is porous and there is opportunity for water reaching it to drain away as rapidly as it comes. A drain under the curb is of little or no value unless it has an ample outlet.

2. If the sanitary sewer is already constructed its size may answer this question. The area draining into the sewer, and its slope, the rainfall, etc., are data which will enable estimates to be made of the amount of water reaching the sewer and if its diameter and gradient are sufficient to carry the storm water reaching it from the paved street in addition to its present maximum flow, then it can be used as a street drain as well as for a sewer, unless the place of discharge or the necessity of purification is such that it is not advisable to combine the two. This question can be answered definitely only after a study of the existing and proposed conditions. It is quite probable that a system of storm water drains would be the most economical, especially if it is possible to empty them on the cross streets. The writer would not recommend putting this burden on the cross streets without knowing all the conditions, for quite possibly it would be far from satisfactory. The storm water drains, if laid, should be below frost line, if possible, under the probable climatic conditions of the borough.

3. Again there is not enough information upon which to base an opinion. Gravel is hardly a paving material unless made into concrete, and broken stone does not form of itself what is called a permanent pavement. If the street is not heavily traveled and is not too steep, a very good result can be obtained with well-constructed broken stone macadam. But constant travel or danger of wash by water because of its amount or rapidity of flow will make the repair bill for macadam too great. Concrete is reported to make a good pavement if well laid and the street is not too steep. Reports of comparatively poor results, when the work is not well designed or constructed, indicate that care must be taken in these respects for concrete as well as other kinds of pavements. Good descriptions of concrete pavements and outlines of specifications for them will be found in MUNICIPAL ENGINEERING, vol. xxxv., p. 36, July, 1908; vol. xxxiv, pp. 168, 329, 336, and in previous numbers, a list of the articles being given in vol. xxxiv, p. 357. The "Handbook for Cement Users" ($3) also gives much of interest in this connection. One of the above articles gives proportions of concrete as 1 Portland cement, 3 sand and 4 crushed stone for the 5½-inch base, and a concrete of 1 part Portland cement and 1½ parts clean crushed monument granite for the 1½-inch top. Others vary somewhat from this, both in proportions and in thickness, but this specification should make as good a concrete pavement as can be constructed. No travel should be permitted on the pavement for at least ten days or two weeks, and the longer the period of curing before using the better the surface will become.

4. First-class Portland cement should be selected for the work. It is now possible to purchase such cements, especially from the Lehigh district in Pennsylvania and New Jersey, which are tested at the mills by laboratories established for that purpose, independent of the cement mills. The tests described in MUNICIPAL ENGINEERING, vol. xxviii, p. 458, do not require a laboratory and require very little apparatus except the standard sieves for testing fineness. They will serve as checks on the delivery of cement tested by the laboratory, or upon the uniformity and general conformity with the specifications of the cement received if it is purchased on the reputation of the brand and the manufacturer.

5. Baker's "Roads and Pavements" ($5), Tillson's "Pavements and Paving Materials" ($5) and Byrne's "Highway Construction" ($5) are all good books, covering all the standard paving materials. The latest revision is that of Byrne's book. If they may be said to have specialties, Baker's has the best treatment of brick pavements, Tillson's of asphalt and Byrne's of macadam. Judson's "Paving for Small Cities" ($3) is also a good book, much more brief in its treatment and not covering the whole field, but doubtless directly applicable in the present case. MUNICIPAL ENGINEERING has the fullest specifications and explanations of the same that can be found in any publication. Almost every number has some specification or description of pavements, and several lists of articles have been published recently. There are articles on and specifications for such pavements as bitulithic, tar macadam, tar and oil-treated roads, concrete, etc., which cannot be found in the text-books, and the recent articles on brick, asphalt and wood are particularly full and have much informa-

tion not to be found in the text-books. The lists of articles are too long to reproduce here, and reference should be made to the volumes of the magazine themselves.

6. This question is answered in this department in vol. xxxii, p. 389. It is there stated that differences of 9 to 20 inches in the elevations of opposite curbs can be made, according to the rule adopted for crowning the pavement, the width of the pavement and the material of which it is made.

The suggestion is made that the employment of a competent municipal engineer, with large experience in sewers and paving, to visit the city and give advice regarding these questions, which can be applied directly to the specific problems, will result in advantages much greater than the expense of the engagement, both in satisfaction and in saving of money.

The Peerless Hand Street Sweeper.

Can you advise me as to the merits of the "Peerless" hand street sweeper? What has been the experience of cities using it? Will it pick up the fine dust?

H. A. CASSEDY, Wilkesbarre, Pa.

The writer has watched the operation of the sweeper named, and was well pleased with the manner in which it picked up dirt and dust from the pavement. Two things are required of a street sweeper, requiring different qualities in it which can hardly exist together. Thus, to remove moist horse droppings which have beeen pressed onto the pavement by wheels, a stiff brush or a scraper is required, while to pick up dust a soft brush is necessary. The power brush sweepers have similar difficulties and seldom pick up dust satisfactorily. The hand sweeper has the advantage of ease of operation, and if the operator is provided with a small scraper to loosen up the small proportion of material which sticks to the pavement, he can keep a street perfectly clean with it, provided the surface is in reasonable repair.

The average operator of a scraper and broom falls into the routine of their use, and sometimes fails to recognize the merits of the hand sweeper because a different set of muscles is called into play and he gets tired the first few days of the new machine, and then he must use his mind to learn the methods of operating the new machine, and that is a wearisome task also. But when the trick is learned, these objections should disappear. It may take some days, therefore, to demonstrate all the good points of the sweeping machine.

Plumbing Ordinance.

Our town has increased in size and population until our old plumbing ordinance is getting out of date. I would like to have some information as to what a plumbing ordinance for a town of 20,000 to 30,000 should be. I have read the article in vol. xxxii, p. 91, as to the tapping of pipes and connections, but I would like to know about the inside plumbing to the curb line.

W. D. N.

———, S. C.

The plumbing ordinance of the city of Indianapolis is one prepared by plumbers and is subject to the limitations of its origin, but will serve quite well for a city of the size named, except that the sections regarding plumbing inspector would probably be omitted and those on examination of plumbers would be modified. Plumbing inspection belongs properly to the city engineer's department in any city, and in a city of the size named, where there is not work enough to keep one man busy inspecting plumbing, the city engineer should be the plumbing inspector and should do the work himself or through one of his assistants under his direction. Likewise the city engineer should determine the qualifications of applicants for plumber's license, with the aid, if thought desirable, of a committee of competent men, at least one of which should be a plumber. Following is the Indianapolis ordinance, and improvements on its provisions will be printed later if our readers will send them to us for that purpose:

The Board of Health and Charities of the city of Indianapolis is hereby authorized, empowered and directed to appoint an inspector of plumbing and house drainage, who shall be a practical plumber residing in the city of Indianapolis, and who shall be required to pass an examination as to his qualifications by a board of three (3) practical plumbers engaged in the plumbing business and residing in said city, said examining board to be selected by the board of health of said city.

Said inspector shall serve during the incumbency of the said Board of Health and Charities, who made the appointment, or until his successor is appointed and shall qualify. The Mayor shall issue to said inspector a certificate of appointment, and the person named therein shall take the oath of office, to be indorsed on said appointment, to support the Constitution of the United States, the Constitution of the State of Indiana, and the city charter of the city of Indianapolis, and to faithfully and impartially discharge the duties of his office to the best of his skill and ability, which certificate and oath shall be filed with the city clerk. Such appointee shall thereupon execute his bond to the city of Indianapolis to the approval of the Mayor, in the sum of one thousand dollars ($1,000), with at least two freehold sureties, or with some approved surety company, payable to the city of Indianapolis, and conditioned on the faithful performance of all duties required of the incumbent of said office, which bond, after being so approved, shall be filed with the city comptroller, who shall make a true copy thereof and file the same with the city clerk, whereupon a

commission shall be issued to the said inspector of plumbing and house drainage, signed by such mayor and attested by the said clerk under the seal of the city.

The salary of such inspector shall be fifteen hundred dollars ($1,500) per year, payable quarterly out of the funds of the said city, at the same time and in the same manner that the elective officers of said city are paid.

After the passage of this ordinance, and the appointment of a plumbing inspector, as hereinbefore provided for, the Board of Health and Charities of the city of Indianapolis is hereby authorized and empowered to and shall appoint a Board of Examiners for the examination and registration of plumbers. Said board shall consist of two practical plumbers in the city of Indianapolis, Indiana, and the regularly appointed plumbing inspector of said city. Said Board of Examiners shall serve during the incumbency of the Board of Health and Charities who made the appointment, or until their successors are appointed and qualified. And said Board of Examination and Registration, exclusive of the plumbing inspector, whose salary is otherwise provided for, shall receive the sum of five dollars ($5) each per year in full for all services rendered the city by them as members of said board.

Said Board of Examiners shall, as soon as may be after their appointment, meet at such time and place as the Board of Health and Charities may designate and at such other times as may be necessary, and proceed to carry out the provisions of this ordinance. Said board shall examine applicants as to their practical knowledge of plumbing, house drainage and plumbing ventilation, and if satisfied as to the competency of any such applicant, the board shall issue a certificate of such competency to such applicant, and the city comptroller shall, upon the presentation of such certificate, issue a license to such person to engage in the business of plumbing in the city of Indianapolis.

Said examinations shall be in writing and a record of questions and answers shall be kept. In event of there being any question as to the character or fairness of such examination, the same shall be referred to a committee of three persons, one chosen by the president of the Board of Health, one by the party questioning the act of the examining board and the third party, a referee selected by the two above chosen. The decision shall be submitted to the Board of Health in writing, and shall be final and conclusive. The referee or umpire thus chosen shall be entitled to a fee not exceeding five dollars ($5.00) a day or fractional part thereof when employed in such matter.

A fee for such examination and license shall be five dollars ($5.00). All fees shall be paid into the office of the city comptroller. In case of a firm, combination of persons or corporation engaged in the business of plumbing desiring to take out license, one member of such firm, combination or corporation may elect to take out license in the manner indicated and which license shall entitle said firm, combination or corporation to do business in the city of Indianapolis.

Before any plumber shall receive a permit under the provisions of this ordinance, he or his firm or corporation shall execute a surety company or freehold bond to the city of Indianapolis, with sureties to be approved by the proper official, in the penal sum of one thousand dollars ($1,000), conditioned for the faithful performance of his or their duties according to the terms of this ordinance, and this bond shall be for the term of one year and shall be renewed annually.

The inspector of plumbing is empowered to examine and inspect all plumbing hereafter installed within the city of Indianapolis; and whenever such plumbing shall be found defective, it shall be the duty of the owner, agent or lessee of such building to place the same in a proper sanitary condition after reasonable notice from the Board of Health. The inspector shall be notified when work is ready for inspection and test, and must examine and approve or reject all work not less than sixteen working hours from the time of such notification. All work shall be left uncovered for examination until the test is made and the work approved by the inspector. The plumbing inspector shall be empowered to make such regulations as shall be necessary for the enforcement of this ordinance, provided such rules or regulations are approved by the Board of Health. He shall keep a recorded list of all licensed plumbers doing business in the city of Indianapolis, Indiana. Where additional fixtures are required or alterations are to be made, and not practicable to be constructed in accordance with the provisions of this ordinance, a special permit may be issued by the inspector of plumbing. It shall be unlawful for any person, firm or corporation to erect, construct or alter, or perform any labor at plumbing or house drainage, within the city of Indianapolis, without first having secured the proper permit provided for in this ordinance.

All permits for plumbing or house drainage shall be issued by the city comptroller after approval by the inspector of plumbing. The fee for issuing permits shall be according to the estimated cost or value of the improvement of plumbing or house drainage at following rates: A nominal fee of fifty (50) cents shall be charged for a permit when the cost shall exceed twenty dollars ($20), but not exceeding two hundred dollars ($200), and fifty (50) cents for each addditional one hundred dollars ($100) or fractional part thereof. Said fees to be paid to the city comptroller when the permit is issued. Each permit shall state specifically the

name of the applicant, the address, number of application, and the date of issue. When additional fixtures are required after the permit is issued, and do not require an extra inspection, no fee shall be charged, except, where the additional fixture or fixtures brings the contract price above the limit for which the permit was issued, in which case the extra amount must be paid according to the specifications herein provided for; and when such additional fixture or fixtures require an additional inspection, an additional charge of fifty (50) cents shall be charged for each subsequent inspection.

Repairs shall be taken to mean repairing or replacing of an old fixture by a new one, to be used for the same purpose; forcing out waste pipes and repairing leaks in waste pipes; but such repairs or alterations shall not be construed to include cases where new vertical or horizontal lines of soil, waste, vent or leader pipes are proposed to be used. Provided: That in a building condemned by the Board of Health because of unsanitary conditions, no plumbing shall be considered as coming under the head of repairs; but all such plumbing shall be done as in the case of new buildings.

Every dwelling house, hotel, apartment house, tenement or business house, factory, store or other building in which plumbing arrangements are to be placed, shall be connected with the city sewer when such sewer is accessible, and, when such sewer is not accessible, with a cesspool in a location to be approved by the inspector of plumbing. The plumbing and ventilation of every building shall be separate and independent from the roof, to the outside of the foundation walls, provided that private stables may be connected with the house drain. That portion of the house drain which is inside the walls and underneath the building, and three (3) feet outside the area or foundation walls, shall be constructed of what is known to commerce as extra heavy cast iron soil pipe and extra heavy standard fittings. Fittings and pipe shall be coated inside and outside with coal tar varnish or any coating equally as good; they shall be securely ironed to the walls, laid in trenches of uniform grade, or suspended to the floor timbers by strong iron hangers, to be approved by the inspector; in all cases a brass clean-out connection shall be placed in drain. There shall be clean-outs at all angles near the exit of drain from building, placed in an accessible location. The end of all drains, or branch drains, shall be provided with a brass clean-out connection, of a size not less than two (2) inches, and placed in an accessible position. Drain and soil pipes shall have a uniform fall of not less than one-quarter of one inch per foot, toward the sewer or cesspool; when such grade cannot be obtained, a special permit may be obtained from the inspector of plumbing for a less fall per foot. No privy or cesspool shall be connected with the sewer or house drain. A running trap, provided with a fresh air inlet and an accessible brass clean-out connection, may be inserted into the house drain, inside or outside of the foundation wall, and as near the said wall as practicable. The fresh air inlet shall be not less than four (4) inches internal diameter connected to the drain on the house side of the trap, and not more than eight (8) feet nor less than four (4) feet from the running trap, and extending to the external air. All drains shall be run as direct as practical. Changes in direction shall be made with regular fittings; and connections shall be made with Y's, sanitary tees, and one-eighth bends. Soil pipes receiving the discharge from one or more water closets shall be of extra heavy cast iron soil pipe, the same as specified for drains, and not less than four inches in internal diameter, and continuing or undiminished in size to the highest roof of the building, above and away from any opening or window, and left open at the top, and shall extend at least twelve (12) inches above the roof; flashing of sheet lead, not less than four (4) pounds to the square foot, or of copper or heavy galvanized iron, shall be provided, and properly attached where the pipe passes through the roof.

No waste pipes shall be less than one and one-quarter (1¼) inches for one (1) fixture and not to exceed two (2) fixtures, and not less than one and one-half (1½) inches for three (3) fixtures and not to exceed four (4) fixtures. Lead waste and vent pipes shall not be of less weight than the grade known as "light." In no case shall the waste pipes from another fixture connect to the house side or in the seal of a water closet trap. No refrigerator or other receptacle in which provisions are stored shall be connected with a drain, soil or vent pipe, or discharge upon the ground beneath the building, but in every case there shall be an open drip tray beneath the refrigerator. The waste must discharge into a sink or other fixture and be provided with a flap valve or discharge end. No steam, exhaust, blow-off or drip pipes shall be connected with a sewer, or with any building, but must discharge into an open tank or condenser from which a perfect connection to the sewer or house drain must be provided. All joints in cast iron pipe shall be packed with picked oakum and run with molten lead, well caulked. Connections of lead pipe with those of iron shall be made with brass or combination ferrules or brass soldering nipples of a size not less than the lead pipe, with properly soldered joints, and caulked or screwed to the iron pipe. All private water service pipes in the ground which are supplied by water from a public water system shall be placed in accordance with the rules and regulations of the Indianapolis Water Company.

Every sink, bathtub, basin, water closet,

urinal, washing or set of wash trays, and every fixture having a waste pipe shall be separately and independently trapped with an approved anti-siphon water-sealing trap, placed as near the fixture as practicable. Traps must be placed above floors or in accessible locations. No trap shall be placed at the foot of a vertical soil or waste pipe. Rainwater leaders within the building shall be of wrought iron or extra heavy cast iron pipes when connected with drain, waste or soil pipes, and shall be suitably trapped.

And where it shall be deemed necessary to provide a system of back venting by special air or vent pipes they shall be of a size not less than the waste pipe up to and including two (2) inches, and not exceeding four (4) inches not less than two-inch vents shall be used. Each vent pipe connection shall be provided with a brass union where it connects to the trap. Such connections shall be made on the crown of the trap where practical, and shall extend at least two (2) feet above the fixture it serves before connecting with the other vent or soil pipe.

When two (2) fixtures connect into one vent, such connection shall be made with not less than one and one-half (1½) inch pipe, and for three (3) fixtures not less than two (2) inch pipe. And for water closets not less than two (2) inch pipe for forty (40) feet or less and two and one-half (2½) inch pipe to be used for an additional twenty (20) feet: Provided, That vent pipes for three (3) or more fixtures with waste three (3) or four (4) inches in diameter, shall not be less than three (3) inch for twenty (20) feet or less; over twenty (20) feet, four (4) inch.

Vent pipes shall be run straight and as direct as practicable, and with a grade to avoid trapping of condensation, but in all cases where vent pipes connect to soil pipes, such connections shall not be less than two (2) feet above the highest fixture. Vent pipes may be run out separately through the roof, and shall be encased the same as soil pipe going through the roof, or when run in, up or out of a heated flue, the casing may be omitted. No pipe going through the roof to be less than two (2) inches in diameter.

Sewer, soil pipe, waste pipe or ventilation pipe shall not be constructed of brick, earthenware or sheet mortar, and chimney flues shall not be used for such ventilators.

Safe pipes, drips or overflow pipes from tanks or cisterns shall be run to some place in open sight and provided with a flap valve on lower end, and in no case shall any such pipe connect with drain, soil, waste, vent pipe or rainwater leader. Every water closet shall be supplied with water from a tank or cistern, and the flush pipe shall not be less than one and one-quarter (1¼) inches in diameter. No person shall place in any building a plunger or pan water closet; and when such kind of closet is removed for repairs or other causes it shall not be replaced. The use of wooden wash trays or sinks in residences, hotels or restaurants is strictly prohibited. They shall be of non-absorbent material: Provided, That wooden sinks may be lined with sheet lead or sheet copper. A grease trap shall be constructed under the sink of every hotel, restaurant, eating house or boarding house, or other public cooking establishment, to the satisfaction of the inspector. The use of mercury vents, or so-called "anti-siphon" traps, shall not be allowed except by permission of the inspector.

Nothing herein contained shall prevent the use of wrought iron soil or waste pipe, with the proper fittings, coated outside and inside, as provided for under cast iron pipe.

The whole system of drain, waste, soil and ventilation pipes shall be made tight and tested with an air or water pressure of not less than ten (10) pounds per square inch, and to stand not less than fifteen (15) minutes without a drop. This test to be made by the plumber in the presence of the inspector; and in all cases where only a part of the system has been tested at one time, the inspector shall require an additional test of the whole system, and it shall be absolutely tight. When the work shall be found to be tight and in accordance with this ordinance, the inspector shall so certify on the back of the permit previously issued for such plumbing work, and no plumbing shall be used until such certificate is made by the inspector.

Books on Transition Curves.

To the list of books on transition curves given in MUNICIPAL ENGINEERING, vol. xxxiv, p. 231, should be added "The Transition Curve," by A. N. Talbot, which one engineer says is the book that treats the subject most simply and rationally.

Books on Hydraulic Dredges.

Are there within your knowledge any books on hydraulic dredges giving their construction and capacity?

P. C. KNIGHT, Pontiac, Ill.

The writer knows of no book containing much detail on this subject. Fowler's "Ordinary Foundations" ($3.50) gives a few pages of valuable information, but not much detail. Probably the best discussion of the subject in point is J. A. Ockerson's paper on "Dredges and Dredging on the Mississippi River," which was published in the *Transactions of the American Society of Civil Engineers*, vol. xl, p. 215, and the discussion of the paper gives much additional information. Other papers in the same transactions are Le Conte's "Recent Dredging Operations at Oakland Harbor, California," in vol. xiii, p. 9; Edwards's paper on "The Improvement of the Channels at the Entrance to the Harbor of New York," vol. xxv, p. 573, and the papers on dredging at the

St. Louis International Engineering Congress, in vol. liv, part C. Charles Warren Hunt, 220 West Fifty-seventh st., New York City, is the secretary of the society.

Telescoping Water Tank Impracticable.

Would it be practical to build a water tank on the same principle as a gas holder on level ground and of about 50,000 gallons capacity? Could the top or cover be weighted sufficiently to obtain a pressure of 75 to 100 pounds?

G. H. L., Arlington, Mass.

While this would be possible, it would not be practicable. The gas in a gas holder is under comparatively slight pressure, and this pressure within the tank is counterbalanced by the weight of the liquid which seals the bottom of the tank. If mercury were used to seal a water tank built on the same principle, the well in which the tank rests would be less than one-twelfth the height of the tank, but if water alone is used, the well must be as high as the tank, and the well therefore takes the place of the tank and we have a standpipe, to which a telescoping tank inside would not be of any benefit. A roof over the tank would cost less than the inner tank and the probable increase in weight of the outer tank, and would serve every purpose that the gas-tank construction would serve. A small tank, with water-tight joint between the telescoping sections, could be used, and is used in some forms of hydraulic elevators, but this construction would not be practicable in a tank of the capacity mentioned.

Cities Having Boards of Water Commissioners.

I am desirous of obtaining the names of the different cities that are operating water works systems by a Board of Water Commissioners, and thought perhaps you might be in a position to furnish me with the same.

C. H. K., Ogden, Utah.

The following cities have boards of water commissioners, some of them elected by the people, some elected by the council, some appointed by the mayor. There are doubtless others. Some of the list is taken from the last edition of the "Manual of American Waterworks" ($5), which is not very definite as to the character of the management, but those given in the list are considered to have what is meant by the term, "Boards of Water Commissioners":

Los Angeles, Cal.; Central City and Colorado Springs, Colo.; Hartford, Lakeville, Meriden, Middletown, New Britain, New London, Norwalk, Norwich, South Norwalk, Willimantic, Winsted, Conn.; Middletown, Milford, Newark, Smyrna, Wilmington, Del.; DeLand, Jacksonville, Key West, Fla.; Atlanta, Augusta, Cartersville, Dalton, Dublin, Fort Valley, Rome, Savannah, Thomasville, Ga.; Algonquin, Bement, Bloomington, Buda, Carrollton, Chadwick, Chicago Heights, Collinsville, Dekalb, Downer's Grove, Dundee, Elgin, Elmwood, Farmington, Flanagan, Forreston, Hoopeston, Litchfield, Mt. Vernon, Rock Island, Springfield, Tolono, Warren, Wilmette, Ill.; Alexandria, Anderson, Columbia City, Dunkirk, Evansville, Fort Wayne, Lafayette, Marion, Peru, Ind.; Armstrong, Bellevue, Grinnell, Ia.; Covington, Fulton, Henderson, Newport, Ky.; New Orleans, La. (sewer and water board); Auburn, Bangor, Booth Bay Harbor, Lewiston, Me.; Baltimore, Md.; Abington, Andover, Arlington, Attleborough, Avon, Beverley, Braintree, Brookline, Cambridge, Canton, Chelsea, Clinton, Concord, Dalton, Danvers, Easthampton, Fall River, Fitchburg, Foxborough, Greenfield, Haverhill, Hinsdale, Holbrook, Holyoke, Hopkinton, Hudson, Ipswich, Kingston, Lawrence, Leicester, Leominster, Lexington, Long Meadow, Lowell, Lynn, Malden, Manchester, Mansfield, Marblehead, Marlborough, Medford, Natick, Newburyport, North Attleborough, Norwood, Peabody, Plymouth, Quincy, Reading, Rockport, Rutland, Salem, Sharon, Somerville (single commissioner), Spencer, Turner's Falls, Webster, Wellesley, Weymouth, Worcester, Mass.; Coldwater, Detroit, Gladstone, Howard City, Ishpeming, Reed City, Rockford, Mich.; Duluth, Moorhead, St. Paul, Minn.; Columbus, Miss.; Grant City, Mo.; Columbus, Neb.; Antrim, Concord, Dover, Farmington, Goffstown, Keene, Lebanon, Meredith, Newport, Peterboro, Portsmouth, N. H.; Atlantic City, Burlington, Newark (street and water), Red Bank, Trenton, N. J.; Afton, Amsterdam, Antwerp, Batavia, Catskill, Cohoes, Ellenville, Fort Plain, Franklinville, Gilbertsville, Gloversville, Gouverneur, Groton, Ilion, Johnstown, Kingston, Manlius, Middletown, Newburgh, North Tonawanda, Plattsburg, Saratoga Springs, Silver Creek, Tarrytown, Troy, Tully, Watervliet, N. Y.; Canal Dover, Cincinnati (new construction), Dayton, Delphos, Eaton, Lynchburg, Millersburg, Minerva, Piqua, Rockford, Toledo, Wapakoneta, O., each styled board of water works trustees; Guthrie, Okla.; Portland, Ore.; Allentown, Altoona, Beaver, Bedford, Bethlehem, Blairsville, Chambersburg, Coatesville, Doylestown, Erie, Hollidaysburg, Homestead, McKeesport, Oil City, Oxford, Reading, Renovo, Pa.; Woonsocket, R. I.; Barton, Bellows Falls, Burlington, Ludlow, Randolph, Windsor, Vt.; Danville, Norfolk, Va.; Wellsburg, W. Va.; Madison, Watertown, Wis.

Brick and Macadam as Foundation for Bitulithic and Asphalt Pavement.

In response to the request for information concerning the use of old brick or macadam pavements as foundation for new asphalt bitulithic or bituminous macadam pavements, made in MUNICIPAL ENGINEERING, vol. xxxiv, p. 361, attention is called by a correspondent to the surfacing of a portion of Sheridan boulevard,

Chicago, with bitulithic, and the subsequent resurfacing of portions of the macadam boulevards on Michigan and South Park avenues and Thirty-third street boulevards by the South Park Commissioners of Chicago, after a thorough examination of the question, which led to the conclusion that the bitulithic surface would resist the wear of the heavy automobile traffic on these boulevards at the same time that it furnishes a clean, smooth, quiet street. The work has been done successfully and easily and the streets are now in constant use.

In MUNICIPAL ENGINEERING, vol. xxiii, p. 77, will be found an article describing and illustrating the process of covering a worn-out pavement of soft brick with a coating of asphalt, to form a new wearing surface.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Construction of Concrete Blocks and Building.

EDITOR OF MUNICIPAL ENGINEERING:

Sir—Pomona College, which is situated at Claremont, is having built a boys' dormitory, 160 ft. by 40 ft. and three stories high, of reinforced concrete, to cost about $40,000. The Richards-Neustadt Construction Co., of Los Angeles, is doing the work on the plan of cost plus a fixed sum. The outside walls, from floors to tops of windows and doors, are built up with hollow concrete blocks. At all points where beams bear on the outside walls, vertical and spiral reinforcement is placed in the blocks, and the spaces are filled with concrete. Lighter reinforcement, both vertical and spiral, is placed at frequent intervals at other points in the hollow block walls, and the reinforcement is protected by concrete. Excellent sand and gravel is obtained on the college grounds, only 800 feet away, so gravel is used instead of broken stone. Concrete for the hollow blocks is mixed quite wet and allowed to remain in the forms about 48 hours. The forms are made very cheaply of wood, with galvanized iron cases. The wet mixture requires very little tamping, and thus some expense is saved.

EDWIN SQUIRE, City Engineer,
Claremont, Cal.

Band Stand for Park—Exterior Plastering.

EDITOR OF MUNICIPAL ENGINEERING:

Sir—In regard to an article appearing in your valuable magazine for July, 1908, I transmit under separate cover a copy of the specifications and contract (see page 10, Sec. 12) for the construction of band stand in Liberty Park, which was constructed in 1907. I also inclose herewith several photographs taken by this department of the stand while under construction and as finished.

The bids received for the construction were $3,237, $3,790, $4,050 and $4,185. A. Campbell, of this city, was awarded the contract at his bid of $3,237. The stand has proven very satisfactory, the acoustic properties being all that could be asked. The original appropriation of $2,000 was made by the city council, but not on estimate furnished by the city engineer.

L. C. KELSEY, City Engineer,
Salt Lake City, Utah.

The plans were given in MUNICIPAL ENGINEERING, vol. xxxv, p. 11, and the accompanying photographs show a front view with part of the forms for the concrete work still in place, and a perspective of the completed stand. Following is an abstract of the principal points in the specifications, applying particularly to the stand:

The foundation is of 1:3:5 gravel concrete, 12 inches thick and at least 2 feet below ground level. The concrete is mixed 13.2 cubic feet of sand, 1 barrel of cement, 3.2 cubic feet, and 22 cubic feet of clean gravel, ⅝ to 1-inch mesh.

The structure is of Oregon fir and pine, as shown on the plans, floor joists being 2 by 8, and rafters, studding and horizontal bracing 2 by 6, 18-inch centers. Roof is covered with 1-inch sheathing laid with tight joints and covered with Ruberoid roofing. Flooring is 1 by 3, with subfloor under band stand of 1 by 8 and inside building of 1 by 4 Oregon fir. Outside finish is of Truckee pine. The large corner

columns are of 3-inch pine or redwood staves, with ¾-inch hardwood splines, all thoroughly glued. Bases of columns are redwood. The caps for columns, egg and dart, and lamb's tongue molds for cornice window brackets and the eagle are of plaster. The shapers for the sounding board are of 1-inch stuff, nailed to 2 by 4-inch bracing, and conform to the curves shown on drawings. The shapers are covered with two thicknesses of ½-inch sheathing, well nailed and drawn in to suit the perfect form of the curves.

The specification for exterior plastering is as follows:

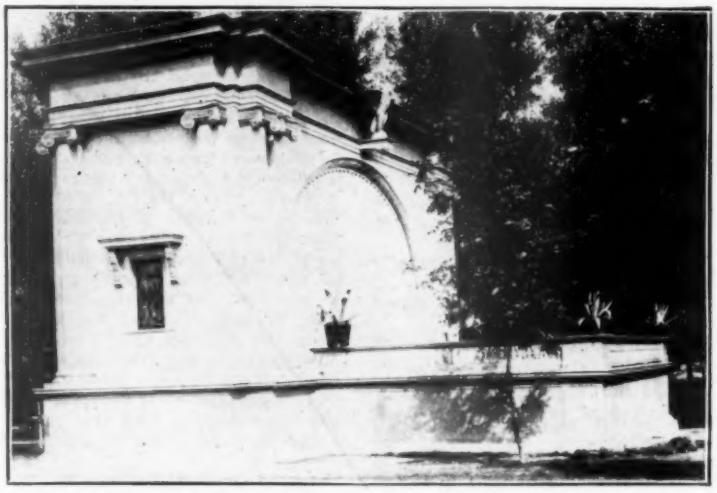
"1. The outside walls and sounding board to be lathed with No. 27 gauge expanded metal or herring bone lath, tightly stretched and with all joints well lapped and nailed not over 6 inches apart with wire staples.

"2. All corners to be made solid.

"3. The first coat to consist of one part English Portland or Iola cement and six parts lime mortar, and the brown coat one part cement, three parts sand and three parts rich lime mortar. The final coat to be a coarse sand finish of one part cement and two parts sand, and to be finished with a rough surface by lifting.

"4. Fresh burned lime, thoroughly strained and clear, and coarse, sharp sand shall be used, and no fine, loamy sand will be allowed.

BAND STAND LIBERTY PARK, SALT LAKE CITY, UTAH.
Forms for Cement Plaster in Place.



BAND STAND IN LIBERTY PARK, SALT LAKE CITY, UTAH.

"5. All plaster work must be covered with burlap or canvas, as soon as applied, and protected from wind, sun or frost, and in case the weather is such that there would be no danger from freezing the burlap or canvas to be kept wet to retard the drying.

"6. The plasterer must take all precautions to insure a first-class job."

Regulation of Engineering Practice.

EDITOR OF MUNICIPAL ENGINEERING:

Sir—Inclosed please find copy of an act regulating the practice of civil engineering and surveying, which has just been passed by the State Legislature in Louisiana, and which may prove of interest to you by reason of the fact that it is the first act of this nature which has ever been passed in the United States.

The framers of this act were under the necessity of making the examinations for surveyors and civil engineers rather mild at the outset, but have the intention of amending the act from time to time, so as to stiffen up in that respect.

The act was indorsed by the Louisiana Engineering Society, and, through their good offices, has finally been made a law.

J. F. COLEMAN, Consulting Engr.,
New Orleans, La.

Following is an abstract of the provisions of the law:

1. No person except those already in practice shall practice civil engineering and surveying without the qualifications stated in the act.

2. Applicants shall present to the Board of Engineering Examiners the diploma of an engineering college or school of good standing or pass a satisfactory examination for surveyor's license in geometry, trigonometry, land surveying and practical use of instruments, and for civil engineer's license natural philosophy or physics is added. He must be 21 years old, of good moral character, and have a fair primary education.

3. The examining board is appointed from a list of practicing civil engineers or surveyors presented by the Louisiana Engineering Society.

4. Full term of members of board is six years, and appointments are made by the Governor on recommendation of the Louisiana Engineering Society.

5. Practicing engineers must register in 90 days.

6. Temporary permits may be issued by any member of the board.

7. Certificates must be recorded with clerk of court before they are valid.

8. A list of licenses is published annually.

9. Compensation of board members is $10 a day and expenses. Fees are $10 for an examination and $1 for certificate, $5 being refunded if applicant fails in examination.

10. Fine for practicing without certificate is $25 to $100, or 30 to 90 days in jail.

11. Permits can be revoked on conviction of immoral conduct before a competent court.

12. Act does not apply to United States engineers or engineers from other States in actual consultation with a Louisiana engineer, nor to those practicing in the State prior to the passage of the act.

13. The board makes an annual report.

Durability of Cement and Concrete in Sewers.

The question of the durability of concrete sewers has been raised first by those who have an interest in the use of other materials and second by such occurrences as that reported from Great Falls, Mont., and is the subject of much study, observation and experiment. It cannot be said that the question is settled or that it can be easily settled, and it may be well to make a statement of the present state of our knowledge that the weak places may be more readily located.

The ordinary use of cement pipe for carrying sewage has continued for many years and there are now many miles of concrete and reinforced concrete sewers in existence as well as of plain and reinforced concrete pipe sewers. There have been some failures of cement pipe sewers, but the circumstances surrounding them do not seem to have cast any doubt upon their suitability for carrying sewage, the quality of the materials or of the workmanship used in making the pipe being the cause of the failure. There are on record occasional instances of the destruction of concrete by discharge of waste from chemical works, and probably cement pipe sewers carrying such discharge would be affected thereby. The same would be true of the cement used in laying brick or in jointing vitrified pipe sewers, and to a certain extent of those materials also. In the Great Falls case referred to the investigators are fully satisfied that the sewage has no effect upon the cement.

Stale sewage, undergoing putrefaction in a tank, may have a deterioating effect on concrete which would not be observed in a sewer where the flow of sewage is continuous and the sewage is comparatively fresh. Thus Mr. W. S. MacHarg and Mr. W. S. Shields, of Chicago, report that concrete septic tanks four or five years old have deteriorated very seriously. Neither of these engineers seems to be prepared to attribute the deterioration unquestionably to the action of the septic sewage upon the concrete, and both are making observations upon the conditions in other tanks and in concrete outfall sewers therefrom to determine if possible the cause of the deterioration and the extent of the action in case it can be attributed to the sewage.

In the Great Falls case Mr. E. T. Tannatt and Mr. Edmund Burke, of the Montana Agricultural College Experiment Sta-

tion, found serious deterioration of concrete sewers and of cement mortar and joints, and also of bricks in brick sewers. Their conclusions are in brief that the deterioration in the brick was due to softness of the brick; that the deterioration in the Portland cement used in the mortar for the brickwork, as well as in the concrete sewer, was due to the alkali in the soil, which was carried into the mortar or concrete by the ground water. This action seemed to be independent of the height of the sewage in the sewer and to be strongest at an elevation above that of the sewage but below that of the ground water.

J. Y. Jewett, of the U. S. Reclamation Service, reports, in a paper before the American Society for Testing Materials, that he has observed deterioration of concrete structures at about the soil line in alkali soils and that this action is similar to that of sea water upon concrete. If this latter suggestion is shown to be correct, it should be possible, by selecting the cement carefully, to find one which will be safe for use under such conditions. Puzzolan and some brands of natural hydraulic cements may prove the proper materials to use, rather than Portland cement.

A cement water pipe 18 years old, in southern California, is reported to be quite seriously clogged by the collection of gravel and lime on mortar projecting from the joints, which hardened and continued to increase the deposits. There is no definiteness about this report, but its indications, so far as they go, are that the composition of the alkali in the soil is the determining factor as to whether the cement pipe will deteriorate or the reverse.

An Artesian Well with Two Waters.

In Riverside Park, Logansport, Ind., there is a flowing well from which both fresh and sulphur waters are obtained. The well was drilled by the city two years ago. An 8-inch pipe was sunk to a depth of 80 feet and a 5-inch casing was placed inside of it. Fresh water from a bed of limestone comes up between the two pipes, and water which tastes and smells strongly of hydrogen-sulphide gas comes up through the 5-inch pipe from a lower stratum in the limestone. The flow of the sulphur water is about one gallon per minute from the drinking fountain, while the fresh water flows with a somewhat smaller volume from the pipe about 20 feet away. A member of the United States Geological Survey visited the well recently and collected samples of both waters and shipped them to the laboratory of the Survey at Washington, D. C., for analysis. A similar well is situated about fifteen miles north of Cincinnati, O., but is non-flowing.

CURRENT INFORMATION

L'Enfant Memorial—Lincoln Memorial—Bay State Gas—Jersey Coast Garbage—House Sewage Disposal—Paying for Improvements—Motors in Snow

Memorial to the Designer of Washington, D. C.

The remains of Major Pierre Charles L'Enfant, whose engineering ability was largely responsible for the streets and parking systems of the District of Columbia, will be removed in September from the Digges farm, in Maryland, to a spot in the campus of the Catholic University. The last Congress appropriated $1,000 to remove the remains and construct a modest memorial stone, with a suitable inscription. The Washington Society of Engineers has been active in the matter, and M. O. Leighton, chairman of the committee having it in charge, has assured H. B. F. MacFarland, chairman of the District Commissioners, that the arrangement to place the body in the campus of the Catholic University meets with the hearty approval of the society.

National Highway as Lincoln Memorial.

A highway extending from Washington, D. C., to Gettysburg, Pa., a distance of 72 miles, is proposed as a national memorial to Abraham Lincoln, by James T. McCleary, in a preliminary report to the Abraham Lincoln Memorial Commission, of which he is a member.

As a special representative of the commission Mr. McCleary was sent to Europe in 1905 to study the great national memorials of the different countries. He obtained facts in regard to arches, shafts, memorial bridges, buildings and statues, and his recommendation is the result of these studies.

Congress appointed the Abraham Lincoln Memorial Commission and appropriated $25,000 for its work. Senator Wetmore, of Rhode Island, is chairman of the commission.

Bay State Gas Receiver Discharged.

A decree was filed by Judge Putnam, in the United States Circuit Court at Boston, July 16, discharging the receivership of the Bay State Gas Company of Delaware. The court directs that claims for attorneys' fees and other matters, amounting to about $50,000, be paid from a sum of $217,000 in the receiver's hands, and that the balance of this amount be turned over to the reorganized Bay State Gas Company.

Garbage on New Jersey Coast.

An effort is being made by Governor Fort, of New Jersey, to put a stop to the garbage nuisance along the New Jersey coast. He has the assurance of co-operation on the part of the New York authorities, who have promised him that they will police New York bay and see that the regulations adopted by the board of health are complied with. The correspondence which has passed in the matter indicates that the trouble comes not so much from the garbage dumped by the city scows as from private contractors, who dispose of garbage and fail to comply with the requirements that it shall be taken far to sea before it is dumped.

House Sewage Disposal.

Among the papers submitted at the third annual meeting of the American Society of Plumbing Inspectors and Sanitary Engineers was one on "House Sewage Disposal," by Henry F. Shade, of Vancouver, Canada, who described a form of septic tank adapted for residences, country hotels, etc. He said, in part, the following:

A few years ago the writer, knowing of several instances where cesspools had been in use for from five to seven years without the necesity of their contents being removed, and having heard of the septic tank experiments at Exeter, started out to investigate with a view of improving the cesspool. It was found that in every case where these pools did not require the removal of sewage at regular intervals, a heavy crust or scum had formed on the top, and the inlet pipe discharged either below the water level of the pool or was so placed that it did not disturb this scum. It was evident from this that the scum produced a septic action sufficient to disorganize a large portion of the organic matter in the sewage, and all that was required to complete the work was to encourage sufficient septic action to cope with and disorganize all the incoming sewage matter.

The first improvements were to enlarge the tank and to submerge the outlet in the same manner as the inlet, at a depth about 2 feet below the water level. The result of this was closely watched; the effluent at first was fairly clear, but finally it gradually darkened, with considerable odor. With the inlet pipe submerged as above mentioned it would often become blocked at the elbow connecting with the horizontal pipe, as the sewage did not have sufficient force to pass down through 2 feet of submerged pipe into the tank. By sounding the bottom of the tank it was found that a heavy black sediment had precipitated. It was evident that the inlet and outlet pipes were carried too far below the water line. Subsequently it was found that if the inlet pipe was brought about 12 inches below the level it would neither disturb the septic scum nor become blocked; also that by raising the outlet to about the center of the depth of the tank, the effluent would not be polluted by the black sediment at the bottom, and at this depth there was no danger of the scum being removed through the outlet leg.

This information was obtained from tanks approximately 6 feet square, intended for the capacity of from six to eight persons. Later, it was found that, by building the tank in proportion to the amount of sewage to be treated and by elongating it so as to eliminate any current or movement in the tank, the scum could be kept absolutely undisturbed. These tanks were calculated on the basis of 40 gallons per capita per day, allowing 2 feet of superficial area for each person.

In localities where there are no facilities for draining of the effluent, and where the soil is of a sandy or porous nature, it is taken care of and distributed by a system of tile drainage or sub-soil irrigation. Ordinarily, it is better to place the tank on the highest ground possible, and as far from the house as convenient (although the latter condition is not imperative), so that the effluent has to percolate into the subsoil, its velocity will be greater through the tile drainage system, and consequently will be discharged over a greater area.

For small septic tanks, filters or contact beds are not generally applicable, for the reason that they require considerable care and attention. For such conditions an underground system of drain tile, carefully laid out, with frequent openings to the surface for the admission of fresh air, is the most effective arrangement. A by-pass around the tank to the sewer line would encourage a draft down the openings and through the tile drain. In this way the effluent is completely aerated and freed from all dangerous pathogenic bacteria. This is, in my opinion, the best system of sewage disposal for isolated houses and will be found to overcome many difficulties which the use of the cesspit produces. It is simple, automatic, and without any siphonic or mechanical appliances I have personally supervised the construction of at least 200 of such tanks and have yet to hear the first complaint of their not working satisfactorily.

Methods of Paying for Public Improvements.

The American Society of Municipal Improvements has collected some data regarding the methods of computing and paying for public improvements, the provisions for paying the assessments and

the method of paying the contractors. The cities reported upon include South Portland, Me.; Haverhill, Newton and Somerville, Mass.; Pawtucket and Woonsocket, R. I.; Bridgeport, Conn.; Troy, N. Y.; Hoboken, Passaic and Bayonne, N. J.; Reading and Erie, Pa.; Charleston, S. C.; Birmingham, Ala.; Grand Rapids, Mich.; Oshkosh and La Crosse, Wis.; Akron and Youngstown, O.; Ft. Wayne and South Bend, Ind.; Joliet and Rockford, Ill.; Dubuque and Sioux City, Ia.; Lincoln, Neb.; Salt Lake City, Utah, and Butte, Mont.

In all these states and cities except South Portland, Me., the assessments are liens on the property, and in this case the assessments are paid in cash. The reports do not state which cities and states collect the assessments in advance of the construction of the improvement.

In the Eastern states there is not entire uniformity in methods of making assessments in cities of the same state, so many granting a special charter for each city, whereas in the Western states there is more uniformity, all cities being incorporated under a general act, though possibly in classes, having slight differences, made necessary on account mainly of differences in population.

In the Maine city the assessments are computed upon area of property and contractor is paid in cash.

In Massachusetts cities there are considerable differences. Haverhill assesses 20 cents per front foot and 0.4 cents per square foot back for 150 feet from the street for sewers, this amounting to about 35 per cent. of the total cost; Newton assesses 15 cents per front foot and 0.55 per square foot for 180 feet back from the street, and Somerville also assesses sewers as well as pavements on basis of frontage and area. Haverhill and Newton make no special assessments for paving. In Somerville owners pay half of cost of sidewalks. In Newton assessments not named are distributed on basis of adjudged benefits. In all the contractor is paid in cash and the assessments are paid in cash or in three to ten annual installments, with interest after two months.

In Rhode Island, Pawtucket assesses sewers at 25 cents per front foot, plus ½ cent per square foot for 100 feet back from street, and Woonsocket 50 cents, plus ¾ cent for 120 feet back. Curbing is paid for by property, setting of it by the city. Other public improvements are paid for by general tax. Contractor is paid in cash and assessments are paid in cash.

In Connecticut assessments are made per front foot, the city paying one-fourth the cost. Contractor receives cash and assessments are paid in cash.

In New York the assessments are made per front foot. Contractor receives cash and assessments are paid in cash or three annual installments, with 6 per cent. interest.

In New Jersey, Hoboken assesses streets by front foot, sewers by area, others similarly, Bayonne making deduction of 50 feet in length of the side of a corner lot, and about the same for sewers, and considering special benefits also. Contractors receive cash or interest bearing improvement certificates for one year or more. Assessments are paid in cash in forty days or in five annual installments.

In Pennsylvania, Reading assesses sewers by front foot and city pays for paving. Erie assesses paving, curbing and sewers by front foot, the city paying for paving street and alley intersections. Reading pays contractor in 6 per cent. bonds and sewer assessments are paid in ten quarterly installments. Erie pays contractor cash or 6 per cent. interest after thirty days for sewers and certified bills for paving. Assessments are paid in thirty days, or in most paving work in ten semi-annual installments.

In South Carolina improvements are paid for by general taxation, and contractor is paid in cash.

In Alabama storm sewers are assessed on area, sanitary sewers and paving by front foot, revised for special cases, and intersections charged on half block in each direction. Contractor is paid in cash and assessments are paid in cash or in ten years.

In Michigan assessments are made according to benefits, street improvements being largely by frontage, city paying for intersections and street railway for its tracks. Contractor is paid in cash and assessments are paid in cash or with 5 per cent. interest.

In Wisconsin, Oshkosh assesses according to benefits and La Crosse per front foot, with rebates on long sides of corner lots. Contractor is paid cash for paving and city's share and in certificates for owner's share of sewer cost. Assessments are paid in cash or five or ten annual installments, with 5 per cent. interest.

Ohio assesses per front foot, except district sewers, which are assessed according to benefits. Contractor is paid in cash and assessments are paid in cash or in several annual payments, with 5 per cent. interest.

In Indiana paving is assessed on frontage, trunk sewers on area of district and local sewers on area of abutting property. Contractor is paid in cash or improvement bonds, which are direct lien on the property for which issued, and assessments are paid in cash in thirty days or in ten annual installments, with interest.

In Illinois assessments are on basis of benefits, but are practically assessed per front foot in most cities. Contractor is paid in cash and improvement bonds, assessments being paid in five to ten annual installments.

In Iowa sewers are assessed on area within 100 feet of street and paving per front foot. Contractor is paid in cash or

improvement certificates, at 6 per cent., and assessments are paid in cash or in seven annual installments, with 6 per cent. interest.

In Nebraska sewers are assessed on area in district, street improvements per front foot. Contractor is paid in city warrants, payable when assessments are made. Assessments are paid on pavements in ten, on grading and sewers in two annual installments.

In Utah assessments are made by frontage, 25 feet being deducted from side of corner lots for sewer assessments. Contractors are paid by special tax warrants, and assessments for paving are collected in ten and for sewers and sidewalks in five annual installments.

In Montana paving is assessed per square foot in special improvement districts, other improvements per front foot, the city paying one-fourth the cost of grading and street opening. Contractors are paid in city warrants and assessments are payable within sixty days of passage of resolution, except that paving can be paid for in three to eight years, with interest at 6 per cent.

Motors and Horses in the Snow.

"Never before was the supremacy of the power wagon more forcibly illustrated than during a heavy snow storm in this city," said E. Q. Cordner, manager of the Automobile Department of the Studebaker Branch in Chicago. "It was a sorry sight to see horses worn and tired, and shivering with the cold, vainly struggling to keep their feet, while, in direct contrast to this, the motor cars, even without chains on the tires, were experiencing no difficulty on the slippery streets. It is under such conditions as these that the electric truck and delivery wagon's superiority over the horse-drawn vehicle is so self-evident. A man who drives a horse for pleasure does not go out in unfavorable weather, but a manufacturer or merchant who must deliver his merchandise day in and day out, cannot be governed by weather conditions, and at such times he is compelled to admit the many advantages of motor delivery as compared with horse delivery."

MUNICIPAL AND TECHNICAL LITERATURE

Municipal Reports.

Report of the Chief Engineer of the Board of Estimate and Apportionment of the City of New York for 1906 and 1907. Nelson P. Lewis, Chief Engineer.

The Board of Estimate and Apportionment is a body which passes upon projects for municipal improvements in all the boroughs of the city of New York, and its chief engineer is its principal adviser. The exact status of the office was not clearly defined at the beginning of its work under the new charter, but as time has passed the importance of the office has developed and the necessity of a larger force and closer organization has been shown. Early in 1907 a reorganization and extension of the work was made, and it is now carried on under three divisions, each with an assistant engineer in charge, and there are also a consulting architect and a consulting engineer on drainage.

Mr. N. P. Lewis has been the chief engineer since the board was established, and his earlier reports covered mainly the street and sewer improvements of the city. This work is now in the Division of Public Improvements, and is reported upon by Arthur S. Tuttle, the engineer in charge, who has a field and office force of nine persons. At the time of the reorganization the bureau having supervision of franchises granted by the city was transferred from the finance department, and is reported upon by Harry P. Nichols, the engineer in charge, who has a force of fourteeen. The work of the Division of Triangulation is reported upon by A. T. Mosman, an assistant on the U. S. Coast and Geodetic Survey, detailed to supervise the work of the eight city employes, who are kept at work whenever there are appropriations available for it. The consulting architect, Walter Cook, reports regarding the inception of the plans for buildings and bridges during the year, and the consulting engineer, Rudolph Hering, reports concerning the special sewerage and drainage problems referred to him.

The effort of this department is to unify the work in the various boroughs and to co-ordinate departments so that there shall be as little duplication and loss of effort as possible, and considerable progress is being made in this direction. The report shows further lines in which similar progress is still to be desired.

Fourth Annual Report of the Shade Tree Commission of East Orange, N. J. 1907. Wm. Solotaroff, Secretary and Superintendent.

This commission has control of the

shade trees in the city. It planted during the year 693 trees and lost 92, most of the losses being of pin-oaks, half of which will be replaced by the nursery. The varieties of trees planted are as follows: Norway maples, 482; sugar maples, 486; pin oaks, 353; red oaks, 63; oriental planes, 184; American lindens, 98; European lindens, 29; ginkgos, 21; American elms, 2. Of these, 162 were planted in the fall of 1904, about 464 in the spring of 1905 and 439 in the spring of 1906. These trees have been planted on eight miles of streets.

The trees on six miles of streets were pruned during the year, making 37 miles in all that have received this attention. Some of the photographs in the report show proper and improper methods of cutting branches, and the results.

Perhaps the most important work of the commission is the treatment of trees to remove insect pests. The persistent work of previous years has been very effective, and the city had no trouble last year with the woolly maple scale nor with the tussock moth. Most of the work of 1907 was done in fighting the elm leaf beetle.

The commission received $2,500 from the city treasury and $2,344.15 from assessments made on property benefited to pay for trees set out. The expenditures are not reported except as "total disbursements," and were about $900 more than the receipts of the year.

Twenty-second Annual Report of the Bureau of Water, Schenectady, N. Y. 1907. Geo. T. Ingersoll, Superintendent.

For the past three years the supply of water for Schenectady has been pumped with centrifugal pumps run by electricity. This report gives the conclusions of the superintendent regarding the efficiency of this method of pumping water. Under the contract with the electric light company supplying the power, the pumps were to have a capacity of 12,000,000 gallons each in 24 hours, pumping against a pressure of 110 pounds. The cost of electricity to operate the plant is $6.50 per million gallons pumped. The other expenses of the station for a year amount to $3.96 per million gallons, or a total of $10.46 per million gallons for supplying the water. Mr. Ingersoll compares this with $7.38, the estimated cost with a modern steam pumping plant and coal at $2.80 per net ton, and with $9.74, the cost in 1902, with the old steam plant of the department, under a pressure of 97 pounds, 10 pounds higher than the average pressure actually produced by the centrifugal pumps.

Three or four centrifugal pumps by two makers, part single-stage and part double-stage, have been used and have furnished from 6,660,000 to 11,610,000 gallons each, at 88 to 104 pounds pressure on test runs, as compared with the contract requirements above stated. There seems to be difficulty in obtaining the electric power necessary to operate the pumps, even at these rates, the current being supplied by the electric lighting company under the terms above stated, but with frequent claims of shortage in amount, although, under the contract, the water works plant has precedence over lighting or street railway in case there is shortage in electricity at the power station. The superintendent therefore protests against the continued use of the centrifugal pumps, the first of which was put in regular service September 19, 1904, and claims that the saving in a steam plant of $4,051, or $3.08 per million gallons, will pay the interest at 5 per cent. on $140,620, which is much more than the steam plant would cost.

Annual Report of the City Engineer of Newton, Mass. 1907. Irving T. Farnham, City Engineer.

Mr. Farnham has eight assistants, including his bookkeeper, and his salary list, including himself, seems to amount to $9,759.01—not a very heavy expenditure for this purpose. The total cost of his office is $18,955.63. There is no statement of the total expenditures for improvements during the year, so that the percentage cost of engineering cannot be determined.

The principal item of expenditure was $60,941.37 on account of elimination of grade crossings by the city and $105,660.78 by the railroad company.

On the portion of Commonwealth avenue in Newton the automobile traffic was restricted to one of the two driveways and horse-drawn vehicles to the other, for the safety of the latter traffic. The city's experience shows that a macadam road will not stand the automobile traffic for a whole year without requiring extensive repairs under the speeding which results from the separation of the automobiles and horses. Several methods of hardening the roadways were tried and the city engineer has computed the cost of the work as follows:

1. Treatment with cement plaster, made 1 part cement and 2½ very coarse sand, swept on the surface about ¼ inch thick with brooms. The average cost per square yard for the 9,939 square yards treated was:

Materials—		
Cement	3.36c	
Sand	.38	
		3.74c
Labor	2.03	
Teaming	1.56	
		3.59
Total		7.33

2. Treatment with tarvia:

Materials—		
Tarvia	3.70c	
Stone screenings	.71	
		4.41c
Labor, placing	4.29	
Teaming	1.86	
Rolling	.59	
		6.74
Total		11.15

3. Treatment with asphaltoilene, 11,947 square yards by contract at 6 cents a square yard.

4. Granolithic automobile tracks, 423 feet long, at 80 cents a linear foot, equivalent in cost to a surfacing 36 feet wide, at 20 cents a square yard.

The success of these experiments is not stated in the report, as they were begun during the period it covers.

Sewers 1.6 miles in length were laid during the year, costing $49,256.68. The summary of sewerage statistics recommended by the sanitary section of the Boston Society of Civil Engineers is used. The separate system is employed, and there are 103.9 miles of sanitary sewers and 54.83 miles of surface water drains.

The city has 18 square miles area, 12 railroad stations, 10 postoffices and 15 "villages," these statistics showing how the population of the city is scattered.

New Publications.

Radio-Activity. By E. Rutherford, McGill Univ., 399 pp., 10 shillings 6 pence. Cambridge Physical Series. Cambridge University Press, Cambridge, England.

The author has given in this book a complete and connected account of the properties possessed by the naturally radio-active bodies, radium, thorium, uranium, etc., to the study and the rapid development of the knowledge of which he has contributed so much. When the general reader sees the extreme complication of the phenomena described in the book and the unusual means it has been necessary to develop in order to observe them, he is greatly surprised at the advancement which has been made in the very few years since the peculiar and elusive phenomena were first scientifically described.

The author explains the results largely on the disintegration theory and shows the effect of the study of the electric properties of gases upon the research in this subject of radio-activity, and includes some study of that subject as an aid to the student.

There is a chapter on methods of measurements and the various experiments are fully described so that the physicist of some education can take up the study of the subject and feel that he has in this book the statement of the important steps that have thus far been taken and a safe guide through them and into the borderland where all scientists in this line are now at work.

ORGANIZATIONS AND INDIVIDUALS

American Society Civil Engineers—American Society Testing Materials—Indiana Water and Health—Technical Meetings—C. L. B. Anderson—F. C. Osborn—Civil Service—Personal Notes

American Society of Civil Engineers.

The fortieth annual convention of the American Society of Civil Engineers was held at Denver, Col., the formal date for the convention being from June 23 to June 26. It had its beginning apparently, however, June 21, when a special train of ten cars left Chicago, and closed June 30, after four days of post-convention, with headquarters at Colorado Springs and excursions from there to various points of interest.

The convention opened June 23 with an address of welcome by Governor H. A. Buchtel, of Colorado, and the annual address by President Charles Macdonald. Among the subjects discussed were the following: "Proposed Constitutional Amendments," "Steel Columns and Struts," "Irrigation," and "Road Maintenance."

The latter discussion was opened by Prof. Arthur M. Blanchard, of Brown University and the Rhode Island Highway Department, who dealt chiefly with experiments conducted in behalf of the State of Rhode Island on roads with heavy motor traffic. These experiments were begun in 1906, when a few hundred feet of tar macadam road was built. Since then a number of miles of main highway have been improved with various kinds of bituminous macadam. Detailed records of materials and costs show that tar from the Providence gas works has cost $3.70

per barrel, pitch $3.70 per barrel and tarvia $5.02 per barrel, on the road to be improved.

The total cost of tar macadam in excess of ordinary macadam has been 12 to 14 cents per square yard. The cost of macadam with 1 part pitch and 3 parts tar and of macadam was 14 cents, and with 1 part tar and 1 part pitch was 13.3 cents per square yard. The latter made an ideal road. Asphalt macadam was satisfactory in quality, but cost 40 cents per square yard; improved methods of mixing might reduce this figure. Tarvia macadam cost 15 cents per square yard.

For improving old macadamized roads having heavy traffic, painting with tar had not proved satisfactory in France and England. The best method for such roads would probably be to scarify the roads to a depth of 3 to 4 inches, then apply tar by the penetration method. The cost would probably be 10 cents per square yard, or less if a machine were used to spread the tar.

In a communication from Massachusetts the treatment of existing macadam parkways was described. After some ten years of use the advent of motor traffic made repairs necessary. In the fall of 1906 some 3½ miles of roads were cleaned and then covered with tar, and finally with screenings. The cost was 6 2-3 cents per square yard. The results were satisfactory. In July and August of the next year it was necessary to re-treat about half of this road and to patch the other half. The re-treatment cost 3½ cents per square yard. In 1907 about twelve miles of gravel road were treated with oil and gas tar, mixed, at a cost of 3 to 3½ cents per square yard. This also lasted about one season.

Resilience is of more consequence under present conditions, in the opinion of James Owen, of Newark, N. J., than the texture of a road or street surface.

The road problem in the stoneless sections of the country, and the harm that has been done in those sections by the advocacy, on the part of outsiders, of expensive roads that could not be built of local materials, was discussed by Prof. Ira O. Baker, of the University of Illinois. He said that in Illinois and Iowa the roads are used chiefly for agricultural purposes, and the traffic is not concentrated. Roads there must be built and maintained at low cost. The road drag is used advantageously for keeping the roads rounded up and well drained at the surface.

American Society for Testing Materials.

The eleventh convention of the American Society for Testing Materials was held at Atlantic City, N. J., June 23, 24, 25, 26 and 27. The main feature of the convention was the address of the president, Dr. Charles B. Dudley, on some of the features of the present steel rail question. The committee on standard specifications for iron and steel reported in favor of three amendments to the standard rail specifications, one of them requiring a drop test on every blow of steel for 85 to 100-lb. rails, the second reducing the quantity of No. 2 rails that might be delivered to 5 per cent. of the order unless the purchaser was willing to take more, and the third absolutely rejecting rails that do not pass the standard drop test. After considerable debate these recommendations were adopted and will be sent out for letter ballot.

The committee on standard specifications for cast iron and finished castings reported that the society's specifications for water pipe were meeting with favor and had been adopted substantially by the American Water Works Association. Attention is being directed, at present, to specifications for foundry pig, and the committee reported that requirements based on chemical analyses were coming into favor rapidly, largely owing to the action taken by the American Foundrymen's Association toward that end. The society, on the recommendation of the committee, voted to co-operate with the association in drafting such specifications.

In a paper by Dr. H. M. Howe and Dr. B. Stoughton the relative corrosion of uncoated steel and wrought iron water pipe were discussed, in which they described tests of steel pipe manufactured at various dates and of wrought iron pipe which were conducted to determine the deepest pitting likely to take place with the metals. The contributors of the paper summed up their tests by saying that steel pitted very much less than wrought iron. This paper brought out an animated discussion between representatives of steel and iron pipe producers. The statement of Dr. A. S. Cushman, that "good steel and good iron would show comparatively little difference, and nobody cared what difference existed between poor grades of these metals," seemed to be the view of those not commercially interested.

An important report was submitted by the committee on the corrosion of iron and steel. Some changes were made in it during the convention and revised copies were not prepared before adjournment.

The report of the committee on standard tests for road materials recommended submission to letter ballot of the abrasion tests for road materials presented by them in 1904 and the ballot was ordered.

Mr. R. S. Greenman, in charge of the testing laboratory of the New York State engineer's office, read a paper on the acceptance of stone for use on roads on the basis of standard tests. He pointed out that only the very best stone should be used on trunk highways exposed to the heaviest traffic, the best stone available for a moderate price should be used on the more important country roads, while stone of low cost alone could be purchased

for minor country roads. He had found standard tests useful, but he believed that the greatest need at the present time in New York State was complete information regarding the road-building stones obtainable in each county. The least satisfactory test he had found to be that for the cementing value of rocks. This last statement aroused considerable discussion. Dr. Cushman stated that while the cementing test was certainly open to criticism it had furnished more useful information than any other. Some very interesting research work connected with it was now being done in the laboratory of the Office of Public Roads, which showed that some rock powders slaked instead of cemented, and that roads built with such rocks would probably be unusually muddy.

During the meeting the society voted to refer to the committee on standard tests for road materials the preparation of standard tests for asphalt and to report as fully as possible on the subject at the next annual meeting.

The committee on standard specifications for paving and building brick reported progress, and that standard requirements would probably be submitted next year.

The committee on standard specifications for cement reported that a number of minor changes in the specifications were desirable, and it was voted to send these amendments out for letter ballot. The committee on reinforced concrete reported progress and stated that a full report would probably be ready next year. It is probable that the report of the committee on waterproofing materials may be included under this heading, for its work up to the present time has related almost entirely to such materials as are added to concrete or applied to its surface to secure impermeability.

Other papers presented treated of tests of reinforced concrete beams under oft-repeated loading, by H. C. Berry; relations of sands to mortar and concrete, by H. S. Spackman and R. W. Lesley; and several on timber testing methods and apparatus.

Indiana Waterworks and Public Health Association.

The conference of waterworks officials of Indiana with the State Board of Health, the program of which was given in the July number of MUNICIPAL ENGINEERING, page 54, was well attended and was carried through exactly according to the schedule. The promise of the program was fully carried out and the papers and discussions were of high order. Several of the papers are printed in full or in part elsewhere in this number and others will appear in later numbers of MUNICIPAL ENGINEERING. At the dinner on Wednesday evening an organization was formed to be known as the Indiana Waterworks and Public Health Association, whose membership is to be drawn from those who are interested in the improvement or preservation of the quality of the water supplies of the state and the prevention of stream pollution. H. E. Barnard, in charge of the laboratory of the State Board of Health, was elected president, Frank Jordan of the Indianapolis Water Company was elected secretary and G. A. Fletcher, city engineer and water superintendent of Brazil, was elected treasurer.

The enrollment reached 75 or more and the cities represented were Indianapolis, Rockport, Columbus, Noblesville, Lafayette, Seymour, Brazil, Richmond, Tipton, Marion, Evansville, Greencastle, Vincennes, Frankfort, South Bend, Mooresville, Greenwood, Terre Haute, Peru, Muncie, Bourbon, Winchester and Anderson, Ind., Pittsburg, Pa., Toledo, O., and New York City, waterworks superintendents and health officers comprising the greater part of the audiences. The organization has made an excellent beginning and should be able to much educational work in preparation for the legislative work which must shortly be accomplished if the state is to put itself into proper sanitary condition as regards purity of water supplies and prevention of stream and well pollution.

Technical Meetings.

The annual convention of the Illuminating Engineering Society will be held at Philadelphia, Pa., October 6 and 7. Van Rensselaer Lansingh, secretary, Engineering Societies Bldg., New York City.

The annual convention of the New England Waterworks Association will be held at Atlantic City, N. J., September 23, 24 and 25. Willard Kent, secretary, 715 Tremont Temple, Boston, Mass.

The American Public Works Association will hold a meeting at Asheville, N. C., September 29 and 30.

The fourteenth annual convention of the Ohio Electric Light Association will be held at Put-in-Bay Island August 25, 26 and 27. Among the papers to be presented are the following: "Should Central Stations Do Wiring?"; "Why Municipal Ownership of Light in Stations Has Not Been a Success"; "How Can We Best Increase Our Business"; "Experience with Luminous Arc Lamps"; "Electric Signs and Other Special Uses of Electricity as an Adjunct to Profitable Station Work"; "Gas and Gasoline Competition and Best Ways to Meet It"; "Lecture on Illuminating Engineering"; "Best Ways and Means of Keeping Out and Getting Out Private Plants in Central Station Territory"; "The Gas Engine in Central Station Work"; "Gas Producing Plants and Oil Engines and Their Results"; "Report Upon the Experience of a Large Number of Central Station Men on the Tungsten Lamp." F. M. Tait, president; D. L. Gaskill, secretary.

The annual convention of the Interna-

tional Acetylene Association will be held in Chicago August 10, 11 and 12.

The sixteenth annual convention of the Society for the Promotion of Engineering Education was held in Detroit, Mich., June 23, 24, 25 and 26, in connection with the convention of the American Society of Mechanical Engineers. The annual address was delivered by Dr. Howe, whose subject was "The Function of the Engineer in the Conservation of Natural Resources." The papers presented related chiefly to instructions and courses for the engineering student. A progress report was offered by Prof. Dugald C. Jackson, secretary of the Joint Committee of Engineering Societies on Engineering Education. The committee has been fully organized, with Desmond Fitzgerald as chairman, and it is expected to proceed with active work and present a final report by July, 1910. Officers were elected as follows: President, Dean H. E. Turneaure, University of Wisconsin; vice-presidents—Dean M. E. Cooley, University of Michigan, and Prof. O. H. Landreth, Union University, Schenectady, N. Y.; members of council to serve three years—Thomas Gray, Rose Polytechnic Institute; L. J. Johnson, Harvard University; W. G. Raymond, Iowa State University; Herman Schneider, University of Cincinnati; C. A. Waldo, Purdue University; W. T. Magruder, Ohio State University.

The National Drainage Association has established offices in the Du Pont building, Wilmington, Del., and will begin a vigorous campaign looking to the drainage, by Government aid, of 80,000,000 acres of swamp and overflowed lands within the United States. In order to facilitate the collection of the necessary data and statistics, the association requests that all owners of such lands, no matter how large or small their holdings, send their names, addresses and numbers of acres of such land owned to it at the above address.

The Municipal League of Indiana, at its meeting in Laporte, June 23-25, discussed the local option question, putting municipal plants under civil service and second terms of city officials. Lafayette was chosen as the next place of meeting and the following officers were elected: President, Councilman J. T. McNary, Logansport; vice-presidents, Mayor Geo. R. Durgan, Lafayette, and Mayor John W. Murphy, Wabash; secretary, Walter Blake, city clerk of Laporte, and treasurer, Loring W. Mellette, former city attorney of Elwood. Chairmen of sections were also selected, the same constituting the executive committee; executive section, Mayor Lawrence Becker, Hammond; legislative, J. R. Colgate, Madison; legal, W. D. Cunningham, Lafayette; police, James McWeeney, South Bend; clerical, George F. Hartwell; engineering, F. R. Charles, Richmond; board of public works, W. O. O'Neal, Richmond.

The third annual convention of the National Association of Comptrollers and Accounting Officers will be held at the Seelbach Hotel, Louisville, Ky., September 22-24, 1908. The program is in preparation and a copy of it will be sent to anyone asking the secretary for it. His address is Howard C. Beck, 61 McGraw building, Detroit, Mich.

C. L. B. Anderson.

Charles L. B. Anderson is a native of New England and a graduate of the Massachusetts Institute of Technology. For two years after graduation he was an instructor in the department of hydraulics and sanitary engineering of Cornell University, Ithaca, N. Y., and has been connected with some of the large municipal works of New York and Pennsylvania. He is an associate member of the American Society of Civil Engineers and of the New England Water Works Association. He has recently formed a partnership with James N. Hazelhurst in practice as consulting engineers under the firm name of Hazlehurst and Anderson, with offices in the Candler building, Atlanta, Ga.

Frank C. Osborn.

Frank C. Osborn was born at Greenland, Ontanagon County, Mich., December 18, 1857. In 1880 he graduated from the Rensselaer Polytechnic Institute with the degree of civil engineer. He entered the employment of the Louisville Bridge & Iron Company, Louisville, Ky., as assistant engineer in June, 1880. In September of the same year he became principal assistant engineer, retaining the position until March, 1885, when he resigned to accept a similar position with the Keystone Bridge Company of Pittsburg, Pa. From 1887 to 1889 he was a member of the firm of G. W. G. Ferris & Co. of Pittsburg, Pa., inspectors and designers of structural steel work, including bridges and buildings.

In 1889 Mr. Osborn retired from the firm and became assistant to M. J. Becker (now deceased and past president of the American Society of Civil Engineers), chief engineer of the Ohio Connecting Railway. In this position he was engaged in reviewing the calculations, designs and working drawings of the bridge then under construction across the Ohio River at Pittsburg. He held this position about four months, resigning to accept the position of chief engineer to the King Bridge Company of Cleveland, O., which he assumed on July 1, 1889, and retained it until July 1, 1892. Mr. Osborn then resigned to embark in private practice as a consulting and designing engineer for structural steel work. In 1894 he took a partner and did business until 1896 under the name of the Osborn Company, civil engineers. In 1896 he bought out the

partner's interest, but continued to do business under the name of the Osborn Company, civil engineers, until 1900. On July 1, 1900, the business was organized as the Osborn Engineering Company and incorporated under the laws of Ohio with a capital stock of $100,000, the other stockholders being associates and employees. The business is still conducted as a stock company and is very likely to continue so, as the plan has proved quite successful and satisfactory. Mr. Osborn is at present, and has been since its organization, president of the company.

He is a director in the Lake Shore Banking & Trust Company and president of the Ohio Litholite Company. He is the author of "Tables of Moments of Inertia and Squares of Radii of Gyration."

Mr. Osborn is a member of the Civil Engineers' Club of Cleveland, and past director, secretary, vice-president and president. He was also a member of the board of managers of the Association of Engineering Societies. He is a member of the American Society of Civil Engineers and was formerly a director; a member of the American Society for Testing Materials and a member of the Association of Railway Superintendents of Bridges and Buildings.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

August 3—Chief engineer, Class 3, in Coast and Geodetic Survey in the Philippines, at $115 a month, with promotion to first-class, at $140 a month, on arrival in Manila.

August 12-13—Assistant in Naval Observatory, Washington, D. C., at $1,400 a year.

August 26—Janitor-engineer in court house and postoffice, Salt Lake City, Utah, at $900 a year.

September 2—Engineer in wood preservation in Forest Service, at $1,000 a year. Eight vacancies.

September 2-3—Inspector of mechanical and electrical engineering in office of supervising architect, Treasury Department, at $2,190 a year.

September 9-10—Civil engineer and superintendent of construction in Quartermaster's Department at Large, at New London, Conn., at $1,500 a year.

A general statement of positions for which examinations will be held in the fall of 1908 has been issued. It includes the following among others: Coast and Geodetic Survey aids; Patent Office assistant examiners; civil engineers in various departments; computers in Nautical Almanac Office, Naval Observatory and Supervising Architect's office; draftsmen, architectural and engineering, in Supervising Architect's office, topographic, heating and ventilating; scientific assistant in Department of Agriculture; superintendent of construction.

Personal Notes.

John B. Moore has been re-elected superintendent of waterworks at Staunton, Va.

William Laughton has been elected assistant superintendent of the water department at Richmond, Va.

J. L. Darnell has been appointed city engineer, to succeed E. A. Harper, M. Am. Soc. C. E., resigned, at Kansas City, Mo.

A. J. Peters has been elected mayor of the newly incorporated town of Deer Creek, Wash.

A. W. Conner, of Lancaster, N. Y., has been appointed assistant engineer to the New York State Water Supply Commission.

William T. Stewart, formerly active as a civil and mechanical engineer in Pittsburg, Pa., died at his home in that city July 7, aged 70 years. Mr. Stewart retired from the practice of his profession about twenty years ago.

James N. Hazlehurst, M. Am. Soc. C. E., and Charles L. Anderson, Assoc. M. Am. Soc. C. E., have formed a partnership as Hazlehurst & Anderson, and will practice as consulting municipal engineers, with offices in the Candler Building, Atlanta, Ga.

Thomas C. J. Bailey, Jr., M. Am. Soc. C. E., has been appointed assistant engineer in the sewer department, District of Columbia, to succeed Asa E. Phillips, M. Am. Soc. C. E., who recently assumed the duties of superintendent of the department.

Nicholas J. Kelly, superintendent of the Lake Erie & Depew Water Company, and formerly chief engineer of the Buffalo General Electric Company, died at his home in Buffalo, N. Y., July 8, from injuries received about two months before when he was thrown from a buggy by the breaking of a wheel.

Aniceto G. Menocal, civil engineer of the United States Navy, retired, and the expert who made the initial surveys affirming the practicability of a ship canal from the Atlantic to the Pacific at Nicaraugua or Panama, died July 20 at his home in Washington, D. C., of arterio-sclerosis, aged 72 years. Mr. Menocal was known as the pioneer projector of the Isthmian canal.

MACHINERY AND TRADE

Technolithic Pavement.

The latest development in street paving seems to be the technolithic pavement, which is the result of the long-continued experiments of Charles E. Guelich, a practical contractor for paving.

The paving material, technolith, consists of limestone, fine sand, pea sand and asphaltic cement, which are mixed and cooked thoroughly in a specially designed machine, until a uniform mixture with strong adhesive properties is produced. Old asphaltic material taken up for repairs can be run through the machine and used in making the mixture for the new material in the patch.

The machine, which is an important factor in making the pavement, may be described as follows:

It is portable, is set on wheeled trucks, and may be hauled by traction engine or two horses, and set as near the work as may be desirable.

The central part of the machine is a cylinder in which the materials are at one time heated and mixed. Stone and sand are carried up from the ground in bucket elevators, one on each side of the machine, and are dumped into the housing surrounding the cylinder. Here they are thoroughly dried and again carried by the buckets from openings at the bottom of the steel housing to the top hopper above the mixer. The asphalt is heated in a tank near the hopper and meets the other ingredients in the mixer.

The mixer is a cylinder 8 feet long and 3 feet 6 inches in diameter. It revolves on four rolls over a soft coal fire, and the paving ingredients are thus mixed and cooked at the same time. Blades, working in the mixer, cut the materials as they enter, and stir them constantly. It is claimed that the physical and chemical changes produced by this process materially improve the quality of the resulting pavement. The mixture is dumped into wheeelbarrows for transfer to the area to be paved.

Each charge of the machine produces 33 cubic feet of technolith, sufficient to cover an area of 13 square yards with a 2-inch pavement. It will turn out four to five batches an hour, when run at a moderate speed, or 52 to 65 square yards of pavement, or, say, 600 square yards a day.

The Lincoln Park Board of Chicago is laying 60,000 yards of the pavement, using eleven men from their regular park force, and, it is claimed, at a saving of 50 to 75 per cent. over the cost of similar paving work previously done for them by others. The Hammond Packing Co., of Chicago, is reported to have reduced the cost of mastic work laid in its yards from 15 to 4 cents per square foot of paving by using this process.

The machinery is operated by a 6-h.p. gasoline engine, and is so compactly and economically designed that it can be sold at a comparatively low price.

Full information about the pavement and the machine will be supplied by the Guelich Portable Asphalt Co., 302 W. Jackson Boulevard, Chicago, Ill.

Gas Statistics.

The 1908 edition of Brown's Directory of American Gas Companies has just been issued, and gives statistics of all the gas plants in North America in the usual convenient form. Financial, technical and business items and names of officers are given, making the directory of much value to those having business with such companies, and also to those who are looking for information in the field. The principal list is of artificial gas companies. The natural gas, acetylene and gasoline plants are also fully reported. The organizations of the parent or holding copies are given, with financial data, and lists of the companies operated by each. The appendix contains more detailed statements of history and financial status of a number of important companies. The book closes with lists of names of members, all the associations in the gas field, and a full descriptive price list of books for gas engineers and superintendents. The book is published by the "Progressive Age," 280 Broadway, New York, and will be sent for $5.

Information About Canada.

Heaton's annual "Commercial Handbook of Canada" ($1) is intended to fill the growing demand for local and specific information about Canada. Travel, postoffice, names of all classes of government officials, money, banks, laws, transportation, shipping, railway and steamship lines, duties, customs, treaties, details of reports of boards of trade of many cities, descriptions of towns, publications containing detailed information concerning localities, opportunities for investment and work in all provinces and much miscellaneous information are crowded into the 384 pages of the book. It is revised

annually, and is purchased by the Canadian government for the use of its agents and British consuls. The issue for 1909, to be published in January, will contain a collection of information under such headings as agriculture, fisheries, lumber, mining, etc., for each province. The book is published by Heaton's Agency, 28 Wellington street, East, Toronto, a firm which acts as commercial and financial agent in Canada for foreign firms.

Use of Large Meters.

Heretofore only the most progressive of water works managers, especially in large cities, have realized the importance of metering the water passing through their large mains. A knowledge of the quantity of water used and the variation in the rate of consumption in the various parts of a system of water works are of great value, and where obtained usually results in material saving and economy of operation.

Heretofore the maintenance, reading and adjustment of large meters has been so great a task that water works managers have hesitated to put them into general use, but where they can be taken care of and read as infrequently and readily as an ordinary house meter, this objection disappears. The Simplex meter, made by the Simplex Valve and Meter Co., Philadelphia, Pa., is such a meter. Its use is extending rapidly. The following table shows the capacities in gallons of Simplex meters for various sizes of pipe:

Size of pipe.	Capacity in gals. per 24 hours.
6 inch	760,000
8 inch	1,360,000
10 inch	2,000,000
12 inch	3,070,000
14 inch	4,100,000
16 inch	5,400,000
18 inch	6,900,000
20 inch	8,500,000
24 inch	12,300,000
30 inch	19,100,000
36 inch	27,500,000
48 inch	49,000,000

A photograph on another page shows the Laurel Run dam, near Hagerstown, Md., on the pipe line from which is located a 16-inch Simplex meter and regulating valve.

Progress in Dust Prevention.

The thousands of experiments for the suppression of dust on macadam roads which have been made all over the country during the past five years, have now developed a vast amount of data on the subject. All kinds of promising compounds which make the dust sticky or heavy have been tried.

Sometimes they have been of a character that would permit of their being dissolved in water and used from an ordinary sprinkling cart, giving to the water a soapy or sticky character to delay evaporation.

Several of these liquids have demonstrated their ability to keep the road dustless for a short period. None of them aim to, or have succeeded in preventing dust formation.

Sea water has also been used in sea coast cities to some advantage, resulting in a considerable saving in sprinkling expense.

Considerable areas have been treated with oils of various grades and gravities, produced from either petroleum or asphalt. Their effect upon the road has lasted considerably longer, and a good treatment with oil will keep the road dustless for weeks, inasmuch as it will not evaporate, but will disappear only by absortpion into the roadway. The serious detriment in the use of oil, however, has been the fact that it is obnoxious to pedestrians. Skirts and shoes are stained by it, and the automobilists and carriage owners often complain of damage to their vehicles.

Moreover, the oily dust which does arise sometimes from an oil-treated road is especially dirty and obnoxious, and property owners on oil treated roads have made much complaint against the treatment.

It has been generally recognized during the last year or two that all these methods are mere palliatives and do not strike at the source of the trouble, namely, the weakness of the natural macadam binder. Under old-style traffic a macadam road wore out very slowly, but automobiles will destroy the finest surfacing in a year, stripping the top dressing down to the No. 2 stone. The water then finds ready access and does great damage.

Many counties, facing the problem of automobile wear, preferred to give up all attempt at maintaining a top dressing of fine screened stone, and have admitted traffic directly upon the coarser stone, which constitutes the second layer. It was recognized that if this mosaic of No. 2 stone could only be made waterproof it would give tremendous durability, inasmuch as the abrasion on this surface as compared with a surface of fine screenings, was practically nil. The mosaic, in fact, on an old road is practically non-dust-producing, but is very susceptible to disturbance by water and disruption by frost.

It has been found that tarvia could be used to make the mosaic waterproof. This tar compound is applied to the road in a liquid condition and hardens among the fine interstices of the roadway somewhat like cement in concrete. It is absolutely waterproof and a road so treated will shed water like the proverbial duck's back. In fact, if the road happens to be imperfectly drained so as to leave puddles after a rain, the water in the puddles will not be absorbed by the road and will only disappear by evaporation.

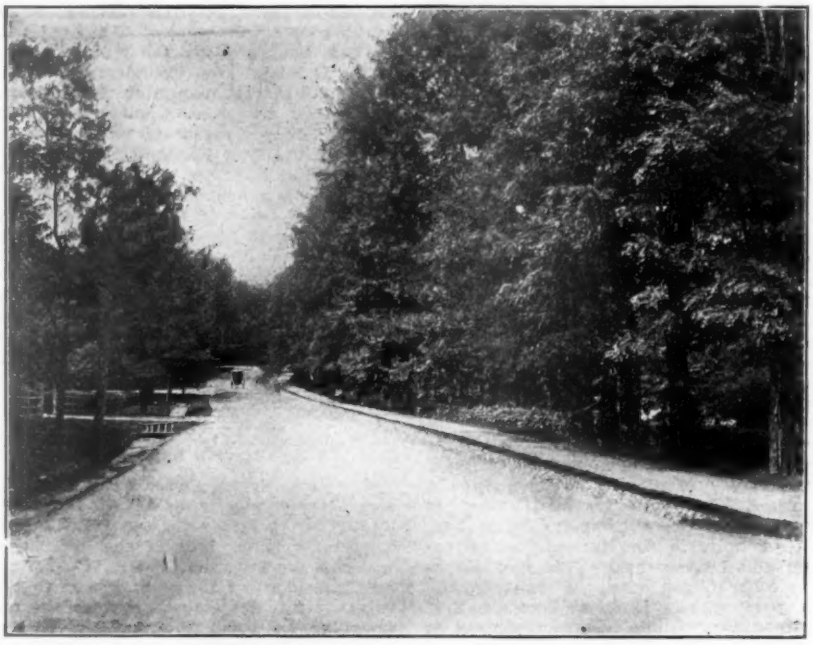
A single treatment with tarvia will give good results for a year, and will frequent-

ly show good effect much longer. Sprinkling is unnecessary, and an occasional cleaning is the only care required.

A treatment with tarvia for such roads costs about $300 per mile and calls for no apparatus except an ordinary sprinkling cart with a special adjustable nozzle.

It is pretty well established that the tarviated surface preserves the road so well as to more than save its cost in the renewal of the stone. Automobile traffic, instead of breaking it up, actually makes it smoother.

It may be objected that the road made of No. 2 stone must be rougher than one with the usual top coat of fine screenings. This is correct, and this style of tarvia is being very rapidly extended as a consequence of the satisfactory outcome of the first experiment.



ROAD IN OYSTER BAY, N. Y., TREATED WITH TARVIA.

treatment would hardly be appropriate for city parks and boulevards, for instance. For village streets, however, and county thoroughfares, where the cost of maintenance is an important consideration, this process of road building can be used to great advantage. The difference is principally a matter of appearance, the slight roughness of the surface not being great enough to affect the comfort of those who ride over it.

The illustration of the road in Oyster Bay, Long Island, shows the effect of tarvia on one of the principal streets of the village nine months after the application of the material. This village was one of the first to experiment with this style of road building, and its use in the vicinity

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Burning Coal Without Smoke.

Bulletin No. 15 of the Engineering Experiment Station, "How to Burn Illinois Coal Without Smoke," by L. P. Breckenridge. The first edition of this bulletin was published in December, 1907, but on account of the large number of requests for it, a second edition of 10,000 copies has just been issued.

A few pages are devoted to the principles of combustion and the losses due to smoking chimneys, but the larger part of the bulletin relates to the constructive features of those boiler settings and furnaces that have been found practically smokeless in operation at the power plant and in the experiment station at the University of Illinois. The leading dimensions of the settings and furnaces are given and sectional cuts show the general character of the settings. While the smokeless burning of Illinois coals furnishes the main discussion, the principles and methods explained apply equally well to the burning of all kinds of soft coal.

A large number of the copies already distributed have been requested by the smoke inspection departments of many of our large American cities.

Copies of this bulletin may be obtained

gratis upon application to the Director, Engineering Experiment Station, Urbana, Illinois.

A Practical and Complete Water Meter Box.

Hartford City, Indiana, enjoys the distinction of being the first and only American city which is completely equipped with water meters and meter boxes, being thus equipped in 1895-6. This advanced step on the part of the municipality of Hartford City is due almost entirely to the untiring efforts of Mr. Edwin H. Ford, who was for many years superintendent of the plant at this place.

In his efforts to secure the adoption of the meter system in Hartford City, Mr. Ford was opposed on almost every side and fought his battle almost alone. Since the meter plan has been fully placed in operation and its effects on the receipts carefully noted, the officials and citizens now would not for a moment entertain a proposition to return to the former unmetered system.

In his position as superintendent of the water works of Hartford City, Mr. Ford encountered the meter box proposition and set about to solve it in the most practical way on the basis that the logical, most convenient and cheapest place to set a water meter was at the point where the water company's pipe ends and the consumer's begins. The result was the invention of the Ford meter box.

While the results of Mr. Ford's first efforts in designing meter boxes were satisfactory for the work then in hand he realized that further improvements were necessary in order to meet the general requirements of water companies. After a careful study of all the objections to be overcome, Mr. Ford perfected what is known as the Ford complete meter box, which is notable for its neatness, durability and convenience. This box differs from other meter boxes in many important particulars. It is so compact that one man can handle, set and connect it in service when trench is open, in ten minutes. He can place a meter in it in less than one minute ready to turn the water on, and he can remove the meter from the box with all working parts in less time. The meter is absolutely protected from frost and surface water. It allows the water to pass in a straight line through the box and meter, thereby cutting out all friction. This places the meter on a level with the service line, which is low enough to prevent freezing, but in addition to this a frost lid is placed between the meter and the surface.

The meter in this position is the same temperature as the water and surrounding ground at this depth, merely cutting out the sweating feature that may trouble the meter face in boxes where meter is elevated in box. In the standard length boxes used in this section of the country the meters are easily read with the naked eye; in the deep settings where ground freezes 3 to 5 feet deep, the boxes are correspondingly long and the meter is read with Ford's reading glass and lamp.

This improved box is complete within itself, being made with brass ports and fitted with brass connections, gaskets and everything necessary for installing the box and fitting the meter without the services of an experienced plumber or any extra expense. It is adjustable to different makes of meters and is lighter in weight than the average meter box by several pounds.

Mr. Ford has always taken great interest in all water-works questions and has been a member of the American Waterworks Association for years. While at the Washington convention this year with his display he met many prominent waterworks people who were well pleased with his box, among others the representatives of the Builders' Iron Foundry, one of the oldest and largest manufacturing concerns in the East, who were so pleased with the box that they secured the exclusive sales right for the New England States.

While this improved meter box has only been on the market a year, it has been adopted by some of the largest and best water works in the country and is in use from Massachusetts to South Dakota and from Minnesota to Kentucky.

An interesting booklet with full description of the Ford meter box which contains much information bearing on this important subject can be had by addressing the Ford Meter Box Co., 112 South High St., Hartford City, Ind.

A New Idea in Rotary Dryers.

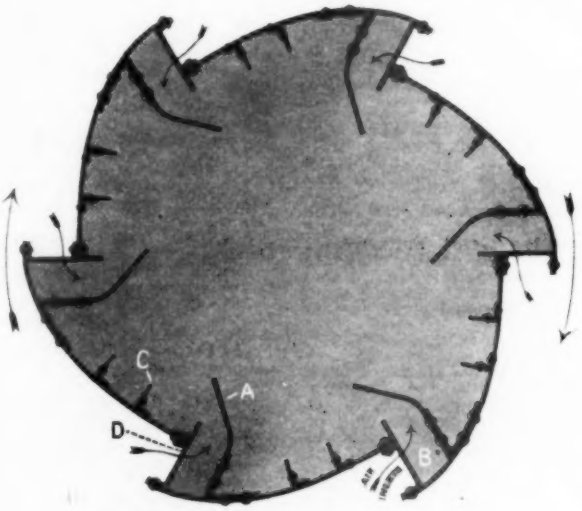
A rotary dryer possessing features of considerable novelty have been developed by the Atlas Dryer Co., of Cleveland, O. The fundamental idea of the new dryer, which is the invention of Mr. W. M. Cummer, president of the company, is that of bringing into direct contact with the material to be dried the greatest possible quantity of heated air.

The manner in which the problem has been solved is very clearly shown in the accompanying figure. From the basic idea of drawing the heated gases through a screen and through the material to be dried, resting on the screen, was evolved the sectional cylinder, so designed that the hot gases and air can be drawn through the periphery and into direct contact with the material, the latter being kept constantly "cascading" by the vanes or lifting blades as the cylinder rotates in a clockwise direction when viewed from the furnace end. The inclination of the cylinder, of course, keeps the material moving longitudinally.

The cylinder, as will be seen from the cut, consists of six curved sections held together by six channel irons running the entire length of the sections. In the channels are slotted openings for the ad-

mission of the heated air and gases. It will be seen that there are six broad, curved lifting blades directly opposite and inside the openings in the channel irons; these perform the dual duty of guarding the air passages, thus preventing the driving material from falling out, and of lifting and cascading the material. The broad blades are assisted in the latter function by the small lifting blades.

A casual consideration of such a cylinder, with peripheral openings of considerable size, is apt to lead to the impression that the material within the cylinder will, in operation, fall through the openings. A study of the figure, either imagining it to rotate or actually rotating it in a clockwise direction, will show how this is impossible. Take the air inlets at the bottom and right of the cut; they are cut in a surface which is in a radial plane; as it rotates under and to the left, material from the blades already up on the ascending side does not commence to fall into the "pocket" formed between the blade and the channel iron until the radial plane of the web of the channel is well past the vertical and the openings consequently at the upper side of the "pocket." Material from the small lifting blades does not fall into the larger until that plane is almost horizontal, hence none of the material can leave the cylinder.



CROSS SECTION OF THE ATLAS DRYER.

Trade Publications.

The July bulletin of the Expanded Metal and Corrugated Bar Co., St. Louis, Mo., gives discussions of special problems met with in the design of highway bridges and culverts and detailed designs of a flat slab bridge, a box culvert and a girder bridge, illustrating the application of the methods suggested.

The first of the new series of pamphlets issued by the Atlas Portland Cement Co., New York, is on reinforced arches built without wooden centering.

Trade Notes.

CEMENT.

Interior, S. D.—A company is being formed here to manufacture cement.

Cement, Wash.—The Phoenix Cement and Manufacturing Co. has been incorporated by Frederick G. Jordan and others.

Chicago, Ill.—The General Concrete Contractors' Association is being organized here for mutual benefit and protection, by Wm. H. Powell, Bernhard Carlson and August Skoglund.

Chicago, Ill.—The Safeguard Concrete Construction Co. is being organized to do all kinds of cement, stone and concrete construction, by F. Cederberg, Rudolph Blome and Johann Haage.

Harrisburg, Ill.—The Harrisburg Concrete, Tile and Construction Co. is being organized to manufacture concrete blocks and sidewalks, by John Melone, David C. Melone and John T. Irwin.

Worthington, Minn.—The Worthington Concrete and Tile Co. has been incorporated by J. N. Gould, S. M. Stewart, Pansy E. Sims and O. M. Kiest.

Sioux Falls, S. D.—The Dakota Portland Cement Co., of this city, has completed arrangements for the construction and operation of a cement manufacturing plant at Chamberlain, S. D.

PURCHASE OF MATERIALS.

Atlantic City, N. J.—Bids are asked until August 5 for a road traction engine and 12 Watson "drop bottom" wagons. Edwin Robinson, chmn. rd. com. of county bd. of chosen freeholders.

Cleveland, Ohio.—Special.—James L. Daugherty, 13355 Euclid ave., is in the market for a full line of clay machinery

for a new sewer pipe and general clay products plant, which he is about to establish in the southwest. Mr. Daugherty established the Streator Clay Mfg. Co. in 1892 and controlled it until January, 1908.

Oklahoma City, Okla.—Special.—W. L. Benham, 232½ W. 9th st., is in the market for concrete mixers.

PROPOSED PURCHASE OF MATERIALS.

Oklahoma City, Okla.—Special.—W. L. Benham, 232½ W. 9th st., is in the market for sewer pipe and concrete ingredients.

Bar Harbor, Me.—Special.—Edgar I. Lord advises us that he is in the market for road building concrete and sewer pipe.

HEAT, LIGHT AND POWER.

Chicago, Ill.—The Duplex Light Co. is being organized to manufacture and deal in gas and electric fixtures, by H. E. Woods, A. J. Woods and H. S. Honey.

Elgin, Ill.—The Elgin Electrical Mfg. Co. is being organized to manufacture and deal in electrical machinery and appliances, by M. E. Hepburn, L. B. Hamlin, Jr., and C. G. Heywood.

Cleveland, O.—Special.—The Atlas Dryer Co. reports the sale of one of their Atlas dryers, Hercules type, for drying nitrate of soda, to the E. I. Du Pont de Nemours Powder Co., of Wilmington, Del. The dryer is to be shipped to Pinole, Cal.

MISCELLANEOUS.

Great Falls, Mont.—Special.—The contract for 10,000 tons of crushed limestone, to be used in the new wall of the head race at the B. & M. smelter, was awarded to Wm. Albright.

Great Falls, Mont.—Special.—The Ryan-Moroney syndicate has secured the capital stock of the Great Falls Water Power and Townsite Co., owning valuable lands, buildings, water power, etc., in this city. The new owners will develop some of the falls of the Missouri river at this city.

WATER.

The Ford Meter Box Co., Hartford City, Ind., have arranged with the Builders' Iron Foundry of Providence, R. I., to act as the exclusive agents for the sale of their meter box in the New England States. Its success in other parts of the country warrants the prediction of a large use of this convenient and safe protection for water and other meters under the somewhat severe conditions of climate in the territory named.

Patents on Concrete Blocks, Bricks and Molds.

848,626. Rocking Mechanism for Building Blocks and Bricks. Frank A. Borst, South Bend, Ind.

848,697. Concrete Block Machine. Manuel Silva and Andrew Lumpp, Springfield, Ill.

848,917. (Ventilator for) Building Block. Edward J. McElligott, and Edwardo A. Cimmery, Manistee, Mich.

849,197. Block Making Machine. Wm. A. Poeck, South Omaha, Neb.

12,626 (Reissue). Supporting Stand and Mold for Making Building Blocks.

849,392. Cement Block Machine. Jas. W. Herring, Mt. Carmel, Pa.

849,732. Concrete Mixer. Ellsworth E. Flora, Chicago, Ill.

849,759. Cement Post. Wm. E. Varney, Wellman, Iowa.

849,790. Process of Curing Concrete Blocks. John W. Jackson, Richmond, Va.

849,824. Apparatus for Making Molded Blocks. Jas. O. Winston, Richmond, Va.

849,936. Mold. Jas. Thomas, Tacoma, Wash.

850,048. Building Block. Sterling T. Playford, Cassopolis, Mich.

850,112. Method of Manufacturing Concrete Blocks for Building Purposes. Sidney W. Hendrickson, White Plains, N. Y.

850,206. Dividing Plate for Block Molds. Frank A. Borst, South Bend, Ind.

850,368. Block Making Machine. Jas. C. Herring, Greensboro, N. C.

850,469. Concrete Mixer. Wm. C. Dayhoff, Bradley, Ill.

850,670. Molding Process. Timothy W. McClenahan, York, Pa.

852,448. Mold. Perry B. Miles, Jackson, Mich.

852,578. Building Block. H. G. Rounds, Bay City, Mich.

852,764. Machine for Making Concrete Blocks. C. O. Brandell, Chicago, Ill.

852,892. Mold for Making Building Blocks. Donald T. McCall, Jackson, Mich.

853,608. Apparatus for Molding Cement Blocks. Jas. B. Talbot, Edwardsville, Ill.

854,000. Machine for Making Cement Tiles, Posts, Pickets, etc. Chas. D. Schroeder, Kansas City, Kan.

854,130. Concrete Block Machine. Walter W. Verner, Delmont, S. D.

854,214. Mold. Jas. T. Hill and Chas. M. Peckham, Norwalk, O.

854,692. Mold for Hollow Building Blocks. Wm. J. Faulkner, Chicago, Ill.

854,708. Building block. Fredrich W. Oelschlaeger, Watertown, Wis.

854,806. Building block and wall. Simeon Crittenden, Chatfield, Minn.

854,843. Mold for concrete building blocks. John H. Rempis, Grand Rapids, Mich.

854,856. Apparatus for manufacturing concrete blocks. Geo. B. Tyler, Hastings, Neb.

855,047, 855,048. Building block and walls. Wm. Curlett, San Francisco, Cal.

855,084. Mold for making plastic blocks. Henry A. Zurbrich, Marion, Ind.

855,091. Mold. Peter A. Bowsher, Terre Haute, Ind.

855,174. Mold for concrete construction. Francis M. Henry, Minneapolis, Minn.

855,633. Shingle mold. Jas. C. Herring, Greensboro, N. C.

855,657. Interlocking building block. A. B. Nichols, Hastings, Minn.

855,822. Apparatus for molding cement blocks. Jas. B. Talbot, Edwardsville, Ill.

856,340. Machine for molding artificial concrete building blocks and artificial stone. Robert Edmondson, South Bend, Ind.

856,383. Building block machine. Wm. J. Armbruster, St. Louis, Mo.

856,852. Cistern mold. Wm. B. Dorward, Lawrence, Kans.

856,866. Portable mold. Wm. L. Hart, West Liberty, Ill.

856,952. Wall mold. Howard H. Hahn, Denver, Col.

856,982. Mold for plastic material. Edward H. McClintock, West Somerville, Mass.

857,159. Mold for concrete blocks. John R. Courter, Montclair, N. J.

857,214. Mold for cement blocks. Carl E. Stockor, Grand Haven, Mich.

857,413. Mold for artificial stone. Frederick Nelson, Menoken, N. D.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Richmond, Ind.—The county commissioners and road officials in Randolph, Union, Henry and Fayette counties, in Indiana, and Preble county, in Ohio, have been extended invitations to attend a good roads congress to be held here August 8.

Bangor, Me.—Mayor Woodman, City Engineer Coombs, Alderman Gorham and Councilman Getchell, members of the committee on streets of the city government, visited Boston and Portland recently, where they inspected several kinds of up-to-date paving in those cities.

CONTEMPLATED WORK.

Oskaloosa, Ia.—Paving is urged for A and 4th sts.

Colfax, Ia.—Paving is contemplated for several streets.

Lincoln, Neb.—Paving is contemplated for several streets.

Eau Claire, Wis.—Brick paving is contemplated for Summit ave.

Neenah, Wis.—Brick paving is contemplated for Wisconsin ave.

Aurora, Ill.—An ordinance has been passed to pave Highland ave.

Minneota, Minn.—Cement walks will be constructed in several streets.

Good Thunder, Minn.—Cement sidewalks will be constructed in Sherman st.

Spring Green, Wis.—A macadam road to the Wisconsin river, 1½ mi., is contemplated.

New Decatur, Ala.—This city has decided to pave a number of business and residence streets.

Salem, Va.—Bids will probably be asked soon for constructing brick or granolithic sidewalks.

Chariton, Ia.—Vitrified brick paving is contemplated for Grand st., from Court to Woodlawn ave.

Normal, Ill.—The improvement bd. has passed a resolution to pave S. Fell ave. with Poston block.

Columbia, S. C.—The city council has under consideration the use of bitulithic for paving Main st.

Burlington, Ia.—Plans are being prepared for brick paving in this city. J. F. Winters, cy. engr.

Little Rock, Ark.—The property owners in W. 2nd and Louisiana sts. desire paving. Mayor W. R. Duley.

Brazil, Ind.—The city council has authorized the construction of 5½ mis. of sidewalks in various streets.

Antigo, Wis.—An ordinance has been passed providing for the issue of $15,000 bonds for street improvements.

Moose Jaw, Sask.—Council has authorized the construction of a number of cement walks and creosoted blocks for crossings.

Kewanee, Ill.—The question of paving the road leading to Pleasant View cemetery is under discussion. Cy. engr. Ingraham.

Superior, Wis.—Bids will be asked for paving 3 blocks of Grand ave. and 5 blocks of 3rd st. with plain macadam.

Rockford, Ill.—The bd. of local impvts. decided, July 18, to pave the downtown business district with brick. Mayor Jardine, chmn. bd.

Waukegan, Ill.—An ordinance has been passed authorizing the construction of a cement concrete sidewalk in Madison st. H. Thacker, cy. clk.

Los Angeles, Cal.—The city council has passed an ordinance providing for the construction of paving and sidewalks in a number of streets.

Litchfield, Ill.—The bd. of local improvements has decided to recommend the paving of N. State, S. State, E. Ryder, Edwards, Jackson and Monroe sts.

Kansas City, Mo.—A petition has been presented to the county court asking that Arlington ave., from Blue ave. to the Independence road, be macadamized.

Virginia, Minn.—A number of wooden walks have been condemned and council has authorized the construction of cement walks, cement crossings and steel gutters.

Valdez, Alaska.—The government road commission has nearly $400,000 available for use on Alaska roads this season, which will be used in improving roads in various sections.

St. Joseph, Mo.—A majority petition was presented to the bd. of pub. wks., July 18, for paving Jule st., from 25th to 26th, with asphalt. Ordinances have been recommended for paving 16th and 12th sts. with Hassam.

Hot Springs, Ark.—Special.—F. V. P. Ellsworth, cy. engr., says this city has formed 4 improvement districts for street paving, aggregating 42,000 sq. yds. of street paving and 17,000 sq. yds. of street railroad paving.

CONTRACTS TO BE LET.

Tampa, Fla.—Bids are asked until August 4 for opening a road. W. L. Parker, chmn. bd. comrs.

Chattanooga, Tenn.—Bids are asked until August 4 for paving a number of streets. Cy. engr. Hooke.

Onawa, Ia.—Bids are asked until August 4 for constructing cement sidewalks. Geo. Underhill, cy. clk.

Tipton, Ind.—Bids are asked until August 3 for constructing gravel roads. J. F. Barlow, co. audt.

Bloomfield, Ind.—Bids are asked until August 5 for constructing 7 gravel roads. S. M. Kerr, co. audt.

Bluffton, Ind.—Sealed bids are asked until August 7 for paving sundry streets. Frank S. Smith, cy. clk.

Chippewa Falls, Wis.—Bids are asked until August 7 for brick paving and curbing. Ed Uehren, chmn. B. P. W.

Pittsburg, Pa.—Bids are asked until August 4 for improving certain highways. Geo. T. Barnsley, ch. road engr.

Newburgh, N. Y.—Sealed bids are asked until 8 p. m., August 3, for grading Van Ness st. D. J. Coutant, cy. clk.

Greensburg, Ind.—Bids are asked until August 3 for constructing a free gravel road. Frank E. Ryan, co. audt.

St. Paul, Minn.—Sealed bids are asked until August 17 for improving Sjostedt road. Edward C. Krahmer, co. audt.

Morris, Minn.—Sealed bids are asked

until August 11 for constructing cement sidewalks. C. B. Burpee, cy. clk.

Chandler, Okla.—Bids are asked until August 3 for constructing cement sidewalks. Jake Collar, chmn. sidewalk com.

Ottumwa, Ia.—Bids are asked until August 3 for constructing 9 blocks of brick paving. J. T. Brady, cy. engr.

Toronto, O.—Sealed bids are asked until August 4 for grading, paving and curbing Market st. D. C. Ault, vil. clk.

Lawrence, Kans.—Bids are asked until August 3 for grading, curbing and paving sundry streets. F. D. Brooks, cy. clk.

Toledo, O.—Sealed bids are asked until August 5 for grading, draining and macadamizing a road. L. B. Bailey, chmn.

Albion, Ind.—Bids are asked until August 11 for grading and constructing cement sidewalks. John W. Earle, co. audt.

Clinton, Tenn.—Sealed bids are asked until August 8 for constructing about 13 mls. of pike road. Levi Foster, chmn. comm.

Vincennes, Ind.—Sealed bids are asked until August 4 for constructing a road in Vincennes twp. John T. Scott, co. audt.

Two Harbors, Minn.—Sealed bids are asked until August 3 for clearing and grubbing 4 mls. of road. H. C. Hanson, town clk.

Ogden, Utah.—Sealed bids are asked until August 10 for constructing curbing and gutters in 22d st. A. F. Parker, cy. engr.

Xenia, O.—Bids are asked until August 8 for constructing 2 1-10 mls. of gravel road in Jefferson twp. Wm. Dodds, co. audt.

Lakewood, O.—Sealed bids are asked until August 3 for grading and constructing sidewalks in Park Row. B. M. Cook, vil. clk.

Fowler, Ind.—Bids are asked until August 17 for constructing a gravel road 13,200 ft. in length. Lemuel Shipman, co. audt.

Frankfort, Ind.—Sealed bids are asked until August 5 for constructing a number of free gravel roads. Chas. F. Cromwell, co. audt.

Vicksburg, Miss.—Bids are asked until August 3 for graveling and constructing gutters in Jackson road. J. D. Laughlin, co. clk.

Lebanon, Ind.—Sealed bids are asked until August 3 for constructing a gravel road in Sugar Creek twp. B. F. Herdrich, co. audt.

Ft. Snelling, Minn.—Sealed bids are asked until August 17 for constructing and repairing roads. Capt. R. C. Croxton, constr. Q. M.

Carrollton, O.—Sealed bids are asked until August 5 for constructing 6,262 sq. yds. of vitrified block paving in W. Main st. Vil. clk.

Martinsville, Ind.—Bids are asked until August 4 for constructing 8,064 ft. of gravel road in Brown twp. B. E. Thornburg, co. audt.

Canton, O.—Sealed bids are asked until August 7 for constructing the subgrade for a macadam road in sec. 10. M. W. Oberlin, co. audt.

Lockland, O.—Sealed bids are asked until August 7 for constructing cement curb and gutters in Washington ave. C. E. Troy, vil. clk.

Columbus, Ind.—Sealed bids are asked until August 3 for constructing 2.77 mls. of gravel road in Clay twp. W. O. Clark, cmmn. co. comrs.

Green Bay, Wis.—Sealed bids are asked until August 10 for grading and macadamizing State st. John Gross, chmn. com. on sts. and bridges.

Caseyville, Ill.—Bids are asked until August 3 for constructing 12,000 to 15,000 ft. of granitoid sidewalks. Henry Koblitz, Sr., vil. clk.

Bronxville, N. Y.—Sealed bids are asked until August 4 for macadamizing Elm Rock road and part of Masterton road. Frank Dinsmore, vil. clk.

Yonkers, N. Y.—Sealed bids are asked until 8 p. m., August 3, for grading and improving sundry streets. Jas. D. McIntyre, secy. bd. sup. and contr.

Bloomfield, N. J.—Bids are asked until August 10 for grading and paving Fairview ave. with telford pavement. Michael Barry, dir., Newark, N. J.

Oshkosh, Wis.—Sealed bids are asked until August 8 for paving Jackson st. with asphalt, with combined curb and gutter. W. A. Marden, prest. B. P. W.

Brookville, Ind.—Bids are asked until August 3 for constructing 10,300 ft. of gravel road in Ray and Salt Creek twps. Chas. A. Miller, co. audt.

Brazil, Ind.—Bids are asked until August 6 for constructing a stone and gravel road in Van Buren and Sugar Ridge twps. Jas. L. Burnes, co. audt.

Cleveland, O.—Sealed bids are asked until August 15 for grading, draining and improving Independence and Parma Town Line road. Wm. F. Black, co. clk.

Muncie, Ind.—Sealed bids are asked until August 6 for grading, draining and paving with brick and crushed stone sundry highways. Jos. E. Davis, co. audt.

Newport, Ind.—Sealed bids are asked until August 10 for constructing Frazer School House gravel road. Carl H. Conley, engr.; H. T. Payne, co. audt.

Sparta, Wis.—Bids are asked until August 5 for constructing 7,204 sq. yds. of brick paving and 4,888 lin. ft. of cement curb and gutter, etc. Cy. clk.

Fort Barrancas, Fla.—Sealed bids are asked until August 24 for the construction and repair of macadam wagon roads here. Capt. D. W. Hand, constr. Q. M.

Harrisburg, Pa.—Bids are asked until August 7 for constructing 4½ mls. of improved highways in Lehigh co. Jos. W. Hunter, chmn. state highway comm.

Richmond, Ind.—Sealed bids are asked until August 15 for grading, draining and paving with gravel 2.89 mls. of road in Washington twp. Demas L. Coe, co. audt.

Greenfield, Ind.—Sealed bids are asked until August 5 for constructing cement sidewalks in N. Franklin st. and constructing brick crosswalks. Oscar O. Bever, cy. clk.

Sullivan, Ind.—Sealed bids are asked until August 3 for constructing 1,320 lin. ft. of stone road in Hamilton twp. S. Boone, chmn. co. commrs.; E. E. Russell, co. audt.

Anderson, Ind.—Sealed bids are asked until August 17 for constructing gravel roads in Pipe Creek and Boone twps. M. J. Brown, chmn. co. comrs.; Wm. T. Richards, co. audt.

Columbus, O.—Sealed bids are asked until August 12 for grading and macadamizing Jewett pike and curbing and paving approaches to the Leonard ave. viaduct. F. M. Sayre, co. audt.

Memphis, Tenn.—Bids are asked until August 14 for constructing 65,000 sq. yds. of asphalt paving on concrete base and for 65,000 sq. yds. of grading. J. H. Weatherford, cy. engr.

Crawfordsville, Ind.—Sealed bids are asked until August 3 for constructing cement walks in Mill, Binford and Chestnut sts. with cement curb and gutter. H. B. Hulett, cy. clk.

Emsworth, Pa.—Bids are asked until August 6 for constructing 9,000 sq. ft. of cement sidewalks and 1,800 ft. of curbing. McBride Sur. and Engrg. Co., 708 Fitzsimmons Bldg., Pittsburg.

Aberdeen, Wash.—Bids are asked until August 5 for filling, graveling, paving, curbing, gutters, storm sewers, catch basins, concrete walks, etc., in dist. No. 219. F. F. Clark, cy. clk.

Jefferson, O.—Sealed bids are asked until August 10 for grading, draining, curbing and paving with vitrified blocks in N. Ridge road. J. C. Rodgers, chmn. co. comrs.; J. S. Matson, co. audt.

Minster, O.—Sealed bids are asked until August 10 for 5,800 sq. yds. of paving in Frankfort st., with grading, setting curbing and laying the necessary tiles and manholes. Joe Laufersweiler, corp. clk.

Flint, Mich.—Bids are asked until August 3 for constructing 10 blocks of macadam pavement, 4,525 lin. ft. of curb and gutter, 634 ft. of sidewalk and pavement combined and 410 ft. of sewer. D. E. Newcombe, cy. clk.

Oshkosh, Wis.—Sealed bids are asked until August 10 for constructing 1 block of cedar block paving on concrete foundation in 13th st. and 3 blocks of tar macadam paving in Mt. Vernon st. W. A. Marden, chmn. B. P. W.

Olympia, Wash.—Sealed bids are asked until August 3 for 7,500 sq. yds. of brick, asphalt, hassam, cement, creosoted wood block or other substantial material, in 4th and Columbia sts. Millard Lemon, cy. engr.; J. R. Dever, cy. clk.

Jacksonville, Fla.—Bids are asked until August 3 for constructing 5,200 sq. yds. of vitrified brick paving in 4th st., 2,796 lin. ft. stone curb and 12 in. circular stone curb and 12 in. circular corner stones. Philip Prioleau, cy. engr.

Rome, Ga.—Sealed bids are asked until August 4 for paving 41,000 sq. yds. of streets with wooden blocks, vitrified brick, granite or bitulithic pavement; 12,000 cu. yds. of earth excavation; 12,000 lin. ft. granite curb and concrete foundations. C. E. McLin, chmn. B. P. W.

Van Buren, Ark.—Bids are asked until August 10 for 10,000 sq. yds. of brick paving on sand foundation, 4,218 cu. yds. of excavation, 420 lin. ft. of castings for street crossings, 190 lin. ft. of cement curbing, 420 lin. ft. of cement curb and gutter. E. L. Matlock, secy. bd. paving comrs.

Davenport, Ia.—Sealed bids are asked until August 4 for paving 11 blocks of 3rd st. with asphalt. The property owners have appointed a committee, with C. A. Ficke as chairman, to secure a good class of paving at as reasonable a price as possible. Mr. Ficke will mail specifications to such contractors as desire to bid on the work, and will also place them in communication with any sub-contractors in this city, should they desire to employ them.

CONTRACTS AWARDED.

Drayton, N. D.—The contract for constructing cement walks was awarded to Campbell Bros.

Buffalo, N. Y.—The contract for repaving Cedar st. with Trinidad asphalt was awarded to Henry P. Burgard.

Cleveland, O.—The Cleveland Trinidad Paving Co. was awarded the contract for paving 13 streets, July 20.

Louisville, Ky.—The contract for constructing granitoid sidewalks was awarded to Staebler & McFarland for $12,000.

Cincinnati, O.—The Kirchner Construction Co. was awarded the contract for paving 4th ave. with brick, for $8,820.50.

Tacoma, Wash.—The contract for repaving St. Helen's ave. with sandstone blocks was awarded to W. J. Murphy, for $24,593.

Findlay, O.—The contract for paving the river road with Malvern block was awarded to C. B. Metcalf, for $6,348.78.

Athens, O.—The contract for constructing 27 mls. of macadam road in Conneaut twp. was awarded to Callahan & Kellogg, for $19,546.

Renovo, Pa.—The contract for furnishing brick for street paving in this city was awarded to the Eagle Fire Brick Co.

Chattanooga, Tenn.—The Southern Paving and Construction Co. was awarded contracts for paving 7 districts, July 7, for $24,000.

Rochester, N. Y.—The contract for resurfacing Meigs st. with trap rock was awarded to H. B. Hooker & Sons, at $1.75 a sq. yd.

Mobile, Ala.—Bigler Bros., of Bessemer, Ala., secured the contract for four sidewalk venturos, involving 3,830 sq. yds. of paving.

Perth Amboy, N. J.—The Standard Bitulithic Co. has been awarded the contract for paving McClellan st. with bitulithic, for $5,842.

Alton, Ill.—The contract for constructing granitoid sidewalk in Sanford st., Upper Alton, was awarded to Belser Bros., of this city.

Plainfield, N. J.—The contract for constructing macadam road has been awarded to the Weldon Contracting Co., of Rahway, N. J., for $7,201.

Salem, N. J.—The contract for constructing the Alloway and Aldine road, 4.76 mls., was awarded to Tuft & Lloyd, of this city, for $19,200.

Aurora, Ill.—The contract for constructing 42,000 sq. yds. of brick paving was awarded, July 9, to the McCarthy Improvement Co., of Davenport, Ia.

East Aurora, N. Y.—The contract for paving Main st. was awarded to the Gipp Construction Co., 531 Ellicott Square, Buffalo, for $7,000.

Joplin, Mo.—The contract for constructing 1¾ mls. of macadamized road, including curbing, gutters and sidewalks, was awarded to S. T. Davis, for about $30,000.

Shenandoah, Ia.—A contract for paving 10 blocks of streets in the 1st and 3rd wards was awarded, July 11, to Hamilton, Rankin & Swartz, at $1.80½ a sq. yd.

Ruston, La.—A contract for constructing 15 mls. of concrete sidewalks was awarded to C. A. DeJersey, of Little Rock, Ark., at 12¼ cts. per sq. yd., or $40,000.

Albany, N. Y.—Paving contracts were awarded, July 13, as follows: Rensselaer st., Mulderry Bros., $18,801.50; Ontario st., John H. Malcolm, $6,189.80.

New Orleans, La.—The Rudolph S. Blome Co., 79 Dearborn st., Chicago, submitted the lowest bid for repaving University ave. with granitoid concrete blocks, for $9,701.

Winona, Minn.—The contract for paving Mart st. with vitrified block was awarded to John Degnan, at $1.25 a sq. yd.; curb, 35 cts. a lin. ft.; retaining curb, 25 cts.

Hampton, Ia.—The contract for paving 10 blocks of business streets was awarded to Magden & Sheely, of Des Moines, at $1.77 a sq. yd., and 25 cts. a lin. ft. for curbing.

St. Joseph, Mo.—The contract for paving Lafayette st., from 32nd to 33rd, with brick, was awarded, July 13, to the Phoenix Brick and Construction Co., at $1.74 a sq. yd.

Columbus, O.—The contract for paving 3 streets with asphalt was awarded, July

13, to A. C. Pugh, as follows: Bryden road, $10,331.20; Oak st., $7,875.40; Franklin ave., $5,799.34.

Mt. Morris, N. Y.—The contract for macadamizing a road from the north line of the state property at Sonyea to the southeast line was awarded to McCarthy & Simerson, of this city, for $10,916.57.

Washington, D. C.—The District Commissioners awarded contracts for paving, July 13, as follows: All asphalt paving to be done during the fiscal year, Cranford Paving Co., $150,000; asphalt block paving, Washington Tile and Block Co., $40,000.

Springfield, Ill.—The contract for paving Washington st., from 1st st. to Amos ave., with brick, was awarded to John M. Striffler, at $1.67 a sq. yd. and 52 cts. a lin. ft. for curbing. The contract for paving Cook st. was awarded to Richard Egan at $1.66 a sq. yd. and 55 cts. a ft. for curbing.

Paducah, Ky.—The contract for constructing 10,000 sq. yds. of bitulithic paving was awarded to the Southern Bitulithic Co., of Nashville, Tenn., at $2.35 a sq. yd. and 3,800 cu. yds. of grading at 45 cts. a cu. yd.

Vincennes, Ind.—Contracts for constructing gravel roads were awarded July 7 as follows: Charles H. Ridgeway, at $6,672; for the gravel road petitioned for by J. T. Draper and others, to W. E. Ruble, at $5,500; for the gravel road petitioned for by John Lindsay and others, to H. F. Jones, at $4,843; for the gravel road petitioned for by J. H. Durham and others, at John S. Rogers, at $8,285.

Newburgh, N. Y.—Bids for paving Liberty st. were submitted July 7, as follows: Standard Bitulithic Co., paving between and 2 feet outside rails of street railway track with either Pennsylvania clay or Clearfield vitrified blocks and the rest of street with Warren's bitulithic, $44,014; Hastings Pavement Co., paving between and 2 feet outside rails of street railway track with either Pennsylvania clay or Mack vitrified blocks and rest of street with 3x5x12-in. asphalt block, $45,658; the same firm also submitted a supplemental bid on 3x5x12-in. asphalt block on a 4-in. concrete foundation, full width of street, $44,742; Atlantic Bitulithic Co., paving between and 2 feet outside rail of street railway track with vitrified blocks and the rest of the street with Warren's bitulithic, $49,908; George H. Gifford, vitrified blocks full width of street, with Pittsburg-Buffalo blocks, $42,280; for the full width of the street with Clearfield blocks, $42,865.

Long Island (L. I.), N. Y.—Bids for regulating and repaving with granite blocks on broken stone and concrete foundation, in Jamaica ave., were received July 15, as follows: Gore Engineering and Contracting Co., $232,976; H. P. George, $178,136; O'Connor & McIntyre, $185,348; H. J. Mullen, $173,373; James Kelly, $232,634; Atlanta Contracting Co., $183,443; Peace Bros., $182,425; T. W. Moran, $190,455; Charles Cranford, $174,310; M. J. Fitzgerald, 547 W. 45th st., New York, $171,522; James E. Quinn, $184,560; Bart Dunn, $213,700. The following bids were received for regulating, grading and repaving with macadam pavement the roadway of Metropolitan ave., from Dry Harbor road to Jamaica ave., 2nd and 4th wards: Long Island Contracting and Supply Co., $24,240; E. S. Brower, $29,950; Peace Bros., $22,750; H. J. Mullen, Postoffice Bldg., Jamaica, L. I., $17,815; Murphy Bros., $24,950; Atlanta Contracting Co., $23,500; Toumbly & Eldert, $27,930; T. F. Tuchy & Co., $24,850.

SEWERS.

CONTEMPLATED WORK.

Denton, Tex.—This city needs a sewerage system.

Oxford, O.—Voted to issue bonds for constructing a sewerage system.

Bellingham, Wash.—The construction of a storm sewer is contemplated.

Hartwell, O.—Voted to issue $35,000 bonds for the construction of sewers.

Anaheim, Cal.—Plans are being prepared for the construction of a sewerage system.

Bangor, Pa.—The question of constructing a sewerage system is under consideration.

Purcell, Okla.—Voted to issue $32,000 bonds for installing a sanitary sewerage system.

Milaca, Minn.—Plans have been completed for extending and improving the sewerage system.

El Centro, Cal.—Plans have been accepted for constructing a sewerage system in this city.

Benton Harbor, Mich.—Resolutions have been passed for constructing sewers in sundry streets.

Mellette, S. D.—Voted to issue bonds for constructing and maintaining a sewerage system.

Houston, Tex.—Plans have been completed for constructing an 11-ft. concrete sewer in Austin st.

Deshler, O.—Bids will be received soon for constructing about 2,000 ft. of sewers. Albert Thompson, vil. clk.

Mt. Oliver, Pa.—Will vote soon on the issue of $100,000 bonds for the construction of a sewerage system.

Hattiesburg, Miss.—Special.—J. H. Putnam advises us that he is in the market for cement pipe for sanitary sewers.

North Tonawanda, N. Y.—Voted to issue $35,000 bonds for the extension of the sewer system in Ironton and Pine Wood districts.

Shelbyville, O.—Plans for a complete sewerage system for this city will be prepared by the Riggs & Sherman Co., of Toledo.

Lansing, Mich.—Plans for a sewerage and water works system in East Lansing were submitted by City Engr. Collar, July 9.

Belleville, Ill.—An ordinance has been passed providing for the construction of sewers in Glass ave. Fred Deutschman, Jr., cy. engr.

Wyoming, O.—Plans and specifications have been completed for the construction of a sewerage system and disposal plant. Josiah Kirby, mayor.

El Paso, Tex.—A sprinkling filter system for sewage disposal has been recommended by G. W. Fuller, cons. engr., of New York City.

Binghamton, N. Y.—Will vote August 14 on the issue of $25,000 bonds for constructing a storm water sewer in Main, Clinton and other West Side streets.

Indianapolis, Ind.—The city health officials are urging the purchase of a large tract of land south of the city to be used as a sewage disposal plant.

Rio Vista, Cal.—Plans are being prepared for the construction of a sewerage system and bids will be asked in about three months. F. J. Kalber, town clk.

Baltimore, Md.—The property owners who are developing land west of Walbrook have asked the bd. of est. for the construction of a sewerage system in that section.

New Britain, Conn.—The bd. of pub. wks. has recommended the construction

of sewers in the East st. extension, South Stanley, St. Henry, Shuttle Meadow and A sts.

Moline, Ill.—The construction of a sewerage or drainage system for that part of East Moline lying north of the railroad tracks and east of 13th st. is contemplated.

Rock Island, Ill.—Council passed an ordinance providing for the construction of sewers in certain streets and alleys in the 7th ward, east of 35th and 38th sts. M. T. Rudgren, cy. clk.

Mishawaka, Ind.—Plans are being prepared for constructing a sewerage system requiring 12 to 18-in. vitrified sewers and 3,100 ft. of 30 and 42-in. reinforced concrete. W. S. Moore, City Hall Bldg., engr.

Newark, N. J.—At a joint conference held July 10 ten municipalities signified their willingness to proceed without delay in the construction of the proposed trunk sewer for the purification of the Passaic river.

Princeton, Ind.—City council authorized, July 25, the construction of a sanitary sewerage system, at a cost of $70,000, which includes all sewers and septic tank equipment. The plans provide for the drainage of an area of 23,000,000 sq. ft.

Isnpeming, Mich.—Plans and specifications have been completed for constructing sewers in the 6th ward, requiring 10,882 ft. of 15-in., 712 ft. of 18-in., 232 ft. of 15-in., 2,197 ft. of 12-in., 2,030 ft. of 10-in. and 13,522 ft. of 8-in. pipe, 23 manholes, 9 flush tanks and 58 catch basins.

Angola, Ind.—Special.—This city has appointed R. L. Sackett, professor of sanitary and municipal engineering, Lafayette, Ind., consulting engineer to this city and to design a complete system of sewerage, including 2 sewage purification plants. These plants will be of the roughing filter type, followed by intermittent sand filtration. Bids will be received about August 15 to September 1 for about $50,000 worth of work, including about $12,000 worth of concrete and filter construction.

CONTRACTS TO BE LET.

Boonville, Ind.—Bids are asked until August 3 for constructing a sewerage system. Cy. clk.

Springfield, O.—Bids are asked until August 7 for constructing sanitary sewers in sundry streets. B. P. S.

Sayre, Pa.—Sealed bids are asked until August 3 for constructing 2,000 ft. of lateral sewer. Sewer com.

Kokomo, Ind.—Sealed bids are asked until August 3 for constructing a sewer in Louisa st. W. T. Meck, cy. clk.

Lawrence, Kans.—Bids are asked until August 3 for constructing main and lateral sewers. F. D. Brooks, cy. clk.

Bronxville, N. Y.—Sealed bids are asked until 8 p. m., August 4, for constructing sewers. Frank Dinsmore, vil. clk.

Rockwell City, Ia.—Sealed bids are asked until August 13 for constructing drain No. 24. B. E. Stonebraker, co. audt.

Emmetsburg, Ia.—Sealed bids are asked until August 4 for constructing drainage improvement No. 29. C. J. Seymour, engr.

Flint, Mich.—Sealed bids are asked until 3 p. m., August 3, for constructing a sewer in Begole st. D. E. Newcombe, cy. clk.

Guthrie, Okla.—Sealed bids are asked until August 6 for constructing district sewers Nos. 39 and 40. E. W. Kinnan, cy. clk.

Miami, Fla.—Sealed bids are asked until August 6 for constructing a trunk or outfall sewer and appurtenances. Cy. clk.

Marshalltown, Ia.—Sealed bids are asked until August 6 for constructing 6,930 ft. of ditch. Erastus Cornell, co. audt.

Webb City, Mo.—Bids are asked until August 3 for constructing sewers in sewer districts Nos. 32 and 33. W. E. Smith, cy. engr.

Bellevue, Ia.—Sealed bids are asked until August 6 for constructing 320 ft. of 8-in. pipe sewer in an alley. W. J. Fay, cy. clk.

Sioux City, Ia.—Sealed bids are asked until 2 p. m., August 3, for constructing the Wolf Creek ditch. E. E. Hosmer, co. audt.

Newburgh, N. Y.—Sealed bids are asked until August 3 for constructing a cement pipe sewer in Prospect st. D. J. Coutant, cy. clk.

Steubenville, O.—Bids are asked until August 3 for constructing sewers in sundry streets and alleys. H. G. Simpson, clk. B. P. S.

Sheffield, Ala.—Sealed bids are asked until August 5 for constructing 1,492 ft. of 8-in. sewer and 4 manholes. C. L. Peckinpaugh, cy. engr.

Woonsocket, S. D.—Sealed bids are asked until August 3 for constructing "Long Lake Drainage Ditch No. 3." Lewis Strand, co. audt.

Morrison, Ill.—Sealed bids are asked until August 6 for constructing 2,315 ft. of sewer. F. A. Van Osdol, chmn.; A. R. Baird, cy. clk.

Jackson, O.—Sealed bids are asked until 1 p. m., September 1, for constructing about 1 2-3 mis. of main sanitary sewer. J. W. Turner, vil. engr.

St. Paul, Minn.—Sealed bids are asked until August 3 for constructing sewers in St. Anthony and Hague aves. John S. Grode, prest. B. P. W.

Toccoa, Ga.—Bids are asked until August 8 for constructing 2,700 ft. of 6 to 15-in. terra cotta sewer from the court house. B. P. Brown, Jr., ordinary.

Louisville, Ky.—Bids are asked until August 24 for constructing section D of the southern outfall sewer, about 1 mi. in length. Bd. sewer comrs.

Des Moines, Ia.—Sealed bids are asked until August 5 for constructing sewers in University and Cottage Grove aves. and 37th st. A. J. Mathis, mayor.

Prospect Park, Pa.—Sealed bids are asked until August 6 for constructing sewers. John S. McCay, clk. coun.; A. F. Damon, Jr., boro surv., Darby, Pa.

Yonkers, N. Y.—Sealed bids are asked until 8 p. m., August 3, for constructing a sewer in Van Slice ave. Jas. D. McIntyre, secy. bd. contr. and sup.

Lakewood, O.—Bids are asked until August 3 for constructing a sewer in Woodward ave. and grading and sidewalks in Park Row. B. M. Cook, vil. clk.

Peru, Ind.—Bids are asked until August 11 for constructing 1,500 ft. of 12-in., 500 ft. of 10-in. and 700 ft. of 6-in. lateral sewer. Wm. O'Hare, cy. clk.

Urbana, Ill.—Bids are asked until August 7 for constructing tile drain and concrete bulkhead or retaining wall. B. F. Youmans, chmn. comrs. drainage dist. No. 1.

Manitowoc, Wis.—Sealed bids are asked until August 3 for constructing vitrified pipe sewers and appurtenances in sundry streets. Arthur Reichert, cy. clk.

Dayton, Ky.—Sealed bids are asked until 8 p. m., August 3, for constructing a concrete or brick sewer in Main, McKinney and Vine sts. Geo. G. Lindsey, cy. engr.

Oakland, Cal.—Sealed bids are asked until August 5 for constructing an extension to the storm sewer in Grove and Jones sts. to Lake Merritt. Walter B. Fawcett, secy. B. P. W.

Fairbury, Neb.—Bids are asked until August 7 for constructing 3,000 lin. ft. of

8-in. tile sewers, 2 flush tanks and 4 manholes in dists. 10 and 11. W. W. Watson, cy. engr.

Carthage, Mo.—Sealed bids are asked until August 10 for constructing a sewer and laterals in sewer district No. 6, with manholes, lampholes, flush tanks, etc. F. B. Newton, cy. engr.

Garwood, N. J.—Bids are asked until August 4 for constructing sewers in North, 2nd and South aves., Cedar, Oak, Centre, Willow, Myrtle and Spruce sts., and Anchor Place. Boro clk.

Vicksburg, Miss.—Sealed bids are asked until September 7 for constructing complete a system of house sewers, approximating 30 mis. of 8 to 27-in. pipe sewers, with 400 manholes and 100 flush tanks. Walter G. Kirkpatrick, cons. engr., Jackson, Miss.

Brooklyn, N. Y.—Sealed bids are asked until August 5 for constructing sewers in sundry streets, involving outlet chamber, 78,000 ft. of yellow pine, 2,500 ft. of 12-in. concrete pipe, 1,409 lin. ft. 186-in. and 960 ft. of 180-in. sewer. Bird S. Coler, prest. boro.

CONTRACTS AWARDED.

St. Paul, Minn.—Christ Johnson secured the contract, July 20, for constructing 3 sewers.

La Crosse, Wis.—The contract for building certain sewers was awarded to Olaf Swennes for $8,000.

Allentown, Pa.—Geo. H. Hardner was awarded the contract for building several sewers, for $16,000.

Salt Lake City, Utah.—Davis & Heuser secured the contract for constructing a sewer on the North Beach.

Columbus, O.—C. T. McCracken & Co. secured the contract for constructing a sewer in Sullivant ave.

Butler, Ind.—The contract for constructing 12 lateral sewers was awarded to the Newman Sewer Construction Co. for $52,000.

Muscatine, Ia.—The contract for constructing a sewer in 5th st. was awarded to R. K. Smith, July 16, for $2,339.06.

Flint, Mich.—The contract for constructing the Mason st. and 6th ave. sewer was awarded to Thomas Bergin for $2,-138.01.

Kingston, Pa.—R. M. Rosser was awarded the contract for constructing sewers in Pulaski, Eno and Payne sts., for $1,271.80.

Newcastle, Pa.—The contract for constructing sewers in Holton and O'Brien sts. was awarded to Mayberry & Son, of this city.

Waterloo, N. Y.—The contract for constructing a sewerage system was awarded to Shepard & Bennett, of Niagara Falls, for $58,000.

Shelby, N. C.—The contract for installing a sewerage and water works system was awarded to H. C. Edwards, of Atlanta, Ga., for $100,000.

David City, Neb.—The contract for constructing a sewerage system was awarded, July 10, to W. M. Lana, of Harlan, Ia., for $9,436.80.

Iron River, Mich.—The contract for constructing a main sewer, with branches, was awarded to P. McDonnell, of Duluth, Minn., for $26,398.70.

Bloomington, Ind.—The contract for constructing a sewerage system here was awarded, July 16, to Wm. H. Harris, of Terre Haute, for $100,419.

Frankfort, Kans.—The contract for constructing a sewerage system was awarded to the George M. King Construction Co., of Des Moines, Ia., for $20,000.

Louisville, Ky.—The contract for constructing sec. A of the 25th st. relief sewer was awarded to Hines Bros., of Canal Dover, O., for about $30,000.

Waterville, Me.—The contract for constructing a section of the Hayden Brook sewer was awarded, July 10, to Drury, McCracken & Gillo, of this city, at $7 a ft.

Cincinnati, O.—The contract for building relief sewers in Central, Harrison and Colerain aves. was awarded to the William Heffron Construction Co. for $43,584.

Omaha, Neb.—J. J. Hanighen, of this city, was awarded the contract for constructing a sewer in Izard st., for $96,-963, and P. L. Kenney & Co. the contract for a sewer in Jones st. at $44,417.

Perth Amboy, N. J.—Sewer contracts have been awarded as follows: Extension of South 1st and South 2nd st. sewers, Hardigan & Dedrickson, $2,536.72; constructing 24-in. sewer in Broad st., Martin Hansen, $5,524.

Indianapolis, Ind.—The contract for constructing the College ave. sewer, which is to be 7 mis. long and will drain a large territory in the northern part of the city, was awarded to the Mansfield Engineering Co.

Red Jacket, Mich.—The contract for constructing the Spruce st. sewer system was awarded to Phil Sheridan, of Hancock, for $5,112.49.

Chicago, Ill.—The John T. Fanning Co. was awarded the contract, July 22, for excavation work for section No. 6 of the North Shore channel of the sanitary district canal, and the contract for cable work at the Wilmette pumping station was awarded to the Standard Underground Cable Co.

Elizabeth, N. J.—Bids for the purification of the Elizabeth river and the prevention of further pollution by the construction of an intercepting sewer in the middle of the stream and a pumping station at the upper end of it, at Union st. and Westfield ave., were submitted as follows: Matthew Wade, Elizabeth, $136,-381.63; Gallo & Musso, Newark, $136,-384.34; J. H. Gray & Co., New York, $177,005; W. J. McCloud & Co., Elizabeth, $194,901; A. E. Sandford & Co., New York, $201,887; Harrison Construction Co., Newark, $212,164.

Mobile, Ala.—Special.—The contract for constructing storm sewers was awarded, July 13, to Jett Bros., of this city, for $28,639.38. The work involves 1,090 ft. of 36-in., 1,920 ft. of 24-in., 760 ft. of 20-in., 1,040 ft. of 18-in., 2,090 ft. of 15-in., 480 ft. of 12-in., 3,220 ft. of 10-in. and 15,350 ft. of 6-in. vitrified pipe; 24 manholes; 54 inlets; 26 special catch basins; 100 cu. yds. extra concrete; 10,000 B. M. lumber; 120 lin. ft. 3x2.5 concrete culvert; 256 lin. ft. 3x2 concrete culvert. The other bidders were: C. M. Burkhalter, Birmingham, Ala., $34,449.50; Boaler & Flynn, Chattanooga, Tenn., $38,093.50; Irwin Bros., New Orleans, $30,202.90; Lee & Everroad, Columbus, Ind., $33,146; Russell & Jennison, Toledo, O., $32,029.50; John B. Turner, St. Louis, Mo., $25,532.60; Sullivan & Long, Bessemer, Ala., $33,-055.50.

WATER WORKS.

Hobart, N. Y.—The Halcottville Water Co. has been incorporated to supply water, by Geo. A. Buckle, A. L. O'Connor, Jas. R. Cowan and others.

East Orange, N. J.—The water department of this city is experiencing considerable trouble through leakage in the new water mains. In many instances holes have been discovered nearly 1 in. in diameter in the pipes, and it is believed that the trouble is due to electrolysis.

CONTEMPLATED WORK.

Spirit Lake, Ia.—A water works system is proposed.

Lake Wilson, Minn.—A water works system is proposed.

Brainerd, Minn.—Voted to issue $120,000 bonds for a water works system.

Aiken, S. C.—A new water supply system is proposed for this city.

Branchville, N. J.—The question of constructing water works will be voted on.

St. Henry, O.—A water works system is contemplated. Wm. H. Romes, cy. clk.

Gridley, Cal.—Voted to issue bonds for installing a water and light system.

Adams, Minn.—Plans are being prepared for the extension of the water works system.

Bellingham, Wash.—This city is preparing to establish an emergency water system.

Burke, S. D.—Voted to issue bonds for constructing a municipal water works system.

Avonmore, Pa.—The citizens of this town are planning to install a water works system.

Duncan, Okla.—This city will make extensions to the water works. Chas. E. Murphy, mayor.

Bonner Springs, Kans.—Voted to issue bonds for the construction of a water works system.

Tecumseh, Neb.—Special.—A. F. Comstock is in the market for c. i. pipe and hydrants.

Lake City, Minn.—Special.—E. L. Lombard advises us that he desires to purchase a 300-h.p. engine.

Gothenburg, Neb.—Plans and estimates for a water works system are being made. C. L. Williams, cy. clk.

Batesville, Ark.—Special.—G. B. Harpole advises us that he is in the market for motor-driven pumps.

East Jordan, Mich.—Voted to issue bonds for extending the water works system. Chas. A. Hudson, vil. clk.

Canton, Ill.—The fire and water committee has reported favorably on the petitions for more water mains.

University Place, Neb.—Special.—E. H. Harbican advises us that he is in the market for motor and power pumps.

East Auburn, Cal.—Special.—W. R. Arthur is in the market for machinery and tools for water works and irrigation.

Kingsland, N. J.—Voted to extend the present water works system and bids for the work of construction will be asked for soon.

Murdo, S. D.—Plans are being prepared for a water works system and the question of issuing bonds will be voted on soon.

Superior, Neb.—Special.—Clarence Hunter advises us that he is in the market for machinery and tools for digging a well 25 ft. in diameter.

Emmett, Idaho.—The Bannock Engineering Co. has been retained by this city to make plans and superintend the construction of a water works system.

Los Angeles, Cal.—Special.—W. T. McBride, 512 S. St. Louis st., desires names of water pipe manufacturers and firms handling other water works machinery.

Chehalis, Wash.—Bids will be received about August 17 for constructing the new plant for the proposed new gravity water works system. W. A. Westover, cy. clk.

Baltimore, Md.—Mayor Mahool has signed the ordinance authorizing the water engineer to employ two expert engineers to examine plans for the new Gunpowder river reservoir.

Rockville, Ind.—The town council has appointed John L. Noel, Samuel Coble and S. A. Pike a committee to begin proceedings to secure ground for a city water supply.

Bemidji, Minn.—A resolution has been passed authorizing the issue of $50,000 bonds for rebuilding the present water works system. The question will be voted on August 11.

Birmingham, Ala.—The American Water Works and Guarantee Co. has retained John W. Hill, of Cincinnati, O., as consulting engineer on the new Cahaba dam for increasing the water supply of this city.

Hancock, Mich.—The bd. of pub. wks. has adopted a resolution urging common council to adopt the revised plans for the extension and development of the water works system. Cy. Engr. Craig.

CONTRACTS TO BE LET.

Fort Wood, N. Y.—Bids are asked until August 3 for lowering water pipe at this post.

Harrisonburg, La.—Bids are asked until August 3 for sinking an artesian well. Police jury.

Fargo, N. D.—Sealed bids are asked until 5 p. m., August 3, for constructing a water main in 12th st. N. C. Morgan, cy. audt.

Russellville, Ala.—Bids are asked until September 1 for constructing a water works and lighting plant. W. H. Austin, town clk.

Wahoo, Neb.—Bids are asked until August 3 (readv.) for installing a water works and electric light plant. L. H. Lytle, cy. clk.

Rhinelander, Wis.—Bids are asked until August 3 for laying a 6 and 4-in. water main in Mercer st. Geo. C. Jewell, chmn. B. P. W.

Cohoes, N. Y.—Bids are asked until August 3 (postponement) for repairing side walls of reservoir No. 3. W. J. Quirk, clk. bd. water comrs.

Cando, N. D.—Sealed bids are asked until August 3 for sinking a 6-in. tubular well not less than 70 ft. or over 1,000 ft. in depth. H. D. Skinner, cy. audt.

Jerseyville, Ill.—Bids are asked August 19 for furnishing and erecting a pumping plant and sluiceways, including equipment. Harmon Engrg. Co., cons. engrs., Peoria, Ill.

Yonkers, N. Y.—Bids are asked until 8 p. m., August 3, for excavating and building a brick suction well at the tube well station. Chas. D. McIntyre, secy. bd. contr. and sup.

New York City.—Bids are asked until September 1 for constructing 3 mis. of plain concrete conduit, 17 ft. high and 17½ ft. in width inside. John H. O'Brien, comr. water sup., etc.

Philipsburg, Mont.—Sealed bids are asked until 8 p. m., August 3, for constructing about 2,000 ft. of flume, a part of the city water system on the south fork of Boulder creek. S. E. McClees, chmn. water com.

Pittsburg, Pa.—Bids are asked until August 3 for constructing filters, pipe gallery, conduits, piping, fixtures and appurtenances in O'Hara twp. A. B. Shepherd, acting dir. pub. wks.

Albany, N. Y.—Sealed bids are asked until August 11 for improving the Erie canal at Little Falls, and modifying dam and constructing guard gates at Rocky Rift. F. C. Stevens, supt. pub. wks.

Danville, Pa.—Bids are asked until August 13 for constructing an addition to the building and mechanical filter plant of the State Hospital for the Insane. W. F. Shay, prest.

Perth Amboy, N. J.—Sealed bids are asked until August 12 for furnishing in lots pipe and fittings, at Rahway, N. J. Richard H. Wilson, prest. N. J. Reformatory Comn., Rahway.

Terre Haute, Ind.—Bids are asked until August 3 for constructing a water main from pressure tanks in the basement of the county jail to the court house. Nathan G. Wallace, co. audt.

Trenton, N. J.—Sealed bids are asked until August 12 for building and erecting a pumping engine for continuous service, with appurtenances, at the pumping station. J. W. Manning, prest. bd. water comrs.

Washington, D. C.—Sealed bids are asked until August 27 for constructing East Park dam, spillway and dikes, located about 12 mis. northwest from Sites, Cal., and involving about 13,500 cu. yds. of concrete and 8,500 cu. yds. of excavation. Jas. Rudolph Garfield, Secy. Dept. Interior.

Chicago, Ill.—Sealed bids are asked until August 3 for constructing a breakwater for the protection of the lake shore front of East End Park; also, for the removal of the present breakwater, for the construction of piers, concrete beach and walk, and for sand filling. A. W. Beilfuss, chmn. special park comn.

CONTRACTS AWARDED.

Douglas, Wyo.—A contract for extending the water works system was awarded to C. Jaeger, of Rich Hill, Mo., for $32,430.

Brownsville, Pa.—The contract for constructing a filter plant at the water works plant was awarded to E. B. Gribble & Co., for $7,000.

Sheridan, Wyo.—The contract for constructing a water works system was awarded to the Katz-Craig Contracting Co., of Omaha, for $219,000.

Rome, N. Y.—The contract for furnishing 4,300 tons of pipe for the new Fish Creek water system was awarded to Chas. Millar & Sons Co., of Utica.

Bennettsville, S. C.—The contract for constructing a water works system was awarded to Abee & Edwards, of Hickory, N. C., for about $27,000.

Plaquemine, La.—This town has awarded a contract for constructing a water works and electric light plant to the Plaquemine Electric Light and Power Co.

Brunswick, Md.—The contract for constructing a water works system was awarded to the Specialty Construction Co., of Norfolk, Va., for $11,448.

Wauwatosa, Wis.—The contract for the extension of the water mains to the county buildings was awarded to the Robert Rom Co., for $21,639.32.

Columbus, Mont.—The contract for constructing the pipe line for the water works system was awarded to Beeman Stocking, of Billings, for $5,000.

New York City.—The contract for constructing the Rondout siphon for the water works system of this city was awarded to the T. A. Gillespie Co., for $6,290,803.

Burley, Idaho.—The contract for constructing a dam and canals for the Oakley Goose creek project was awarded to the Fario-Kesi Construction Co. for $750,000.

Owego, N. Y.—The contract for constructing a new reservoir for the Owego Water Works Co. was awarded to the P. B. McGahey Co., of Little Falls, for $10,000.

Batavia, Ill.—The contract for the extension of the water works system was awarded to the United States Wind Engine and Pump Co., of this city, for $10,823.09.

Philadelphia, Pa.—The contract for constructing a reinforced concrete reservoir and a pump house for the Ivins, Dietz & Metzgar Co. was awarded to Cramp & Co.

Overbrook, N. J.—The contract for constructing a water supply and sewerage system at the county hospital was awarded to the Harrison Construction Co., of Newark, for $49,609.

Washington, D. C.—The contracts for furnishing curb and corporation cocks were awarded to the Anderson Coupling Co., the A. P. Smith Mfg. Co. and the H. Mueller Mfg. Co.

Pitttsburg, Pa.—The contract for constructing a water softening and purifying plant was awarded to the Wm. B. Scaife & Sons Co., of this city, by the Tennessee Coal, Iron and R. R. Co., for $50,000.

Charter Oak, Ia.—The contract for the extension of the water mains and the erection of a reinforced concrete tank and reservoir was awarded to the South Dakota Concrete Construction Co., of Rapid City, S. D.

BRIDGES.

Auburn, Ind.—Bids are asked until Aug. 4 for building bridges. Bd. co. comrs.

Covington, Ind.—Bids are asked until Aug. 14 for constructing 2 bridges. Bd. co. comrs.

Cleveland, O.—Bids are asked until Aug. 22 for constructing the new Rocky River bridge. Co. comrs.

Linton, N. D.—Bids are asked until Aug. 17 for building 2 steel bridges. J. G. Pitts, co. audt.

Delphi, Ind.—Bids are asked until Aug. 3 for building a bridge here. W. H. Bradshaw, cy. engr.

Newport, Ind.—Bids are asked until Aug. 10 for constructing 3 small bridges. T. Payne, co. audt.

Cleveland, O.—Bids are asked until Aug. 8 for building a bridge. Wm. F. Black, clk. bd. co. comrs.

Newton, Kan.—Bids are asked until Aug. 3 for constructing a bridge in Emma twp. B. O. Hagen, co. clk.

Rochester, N. Y.—Plans have been completed for new canal bridges at Allen st. and Lyell ave.

Spokane, Wash.—Plans have been submitted for a bridge across the Spokane river at Madison ave. and Howard ave.

Crawfordsville, Ind.—Bids are asked until Aug. 8 for constructing a bridge in Wayne twp. Bennett B. Engle, co. audt.

Noblesville, Ind.—Bids are asked until Aug. 4 for building 2 concrete arch bridges. N. W. Cowgill, co. audt.

Leavenworth, Kan.—Plans are being prepared for constructing 15 small bridges and culverts. J. W. Niehouse, co. clk.

Weatherford, Tex.—This city voted to issue bonds to rebuild the bridge on Main st. and to construct 2 new bridges.

Marion, Ind.—Bids are asked until Aug. 4 for constructing a steel bridge with reinforced concrete floor. Co. comrs.

Rockville, Ind.—Bids are asked until Aug. 4 for constructing and repairing bridges. Samuel Coble, chmn. co. comrs.

Eaton, O.—Bids are asked until Aug. 6 for constructing the substructures of certain bridges. C. W. Eidson, co. audt.

San Antonio, Tex.—Bids are asked until Aug. 12 for building a steel bridge across the San Miguel river. W. C. Wheeler, co. judge.

Jefferson, O.—Bids are asked until Aug. 10 for constructing a plate girder bridge over Rock Creek. P. C. Remick, co. audt.

Liberty, Ind.—Bids are asked until Aug. 3 for building a concrete arch on College

Corner and Richmond Pike. Clinton Gardner, co. audt.

Indianapolis, Ind.—Sealed bids are asked until Aug. 12 for building a bridge over Big Eagle creek at W. Washington st. Albert Sahm, co. audt.

Stroudsburg, Pa.—Bids are asked until Aug. 10 for erecting a bridge in Hamilton twp. over McMichaels creek. Milton Metzgar, chmn. co. comrs.

Rochester, Ind.—Bids are asked until Aug. 3 for constructing 6 steel and wrought iron bridges in Liberty twp. Geo. W. DuBois, co. audt.

Bethlehem, Pa.—Bids are asked until Aug. 6 for constructing a reinforced concrete bridge over the Monocacy at Broad st. L. A. Francisco, co. engr., Easton, Pa.

St. Joseph, Mich.—Bids are asked until Aug. 12 for constructing a swing bridge and approaches on State st. over the St. Joseph river. H. G. Ensley, chmn. bridge com.

Douglas, Ga.—Bids are asked until Aug. 13 for constructing the substructure and trestle approaches of a bridge across the Altamaha river. G. B. Hazelhurst, ch. engr.

Paoli, Ind.—Bids are asked until Aug. 4 for constructing a new bridge across the bayou on the New Albany and Vincennes road. Alvin B. Ham, co. audt.

Kokomo, Ind.—Bids are asked until Aug. 6 for building a reinforced concrete culvert near West Liberty. Wm. L. Benson, co. audt.

Richfield, Utah.—Bids are asked until Aug. 5 for constructing 26 concrete culverts for passing the natural drainage water under the Piute Canal, and for the abutments of 10 bridges to carry traffic over said canal. Thos. C. Callister, secy. state bd. of land comrs., Salt Lake City.

Fort Scott, Kan.—Sealed bids are asked until Aug. 5 for constructing a substructure, consisting of stone abutments, wings, riprap, fill and excavation for 1 iron bridge; a stone arch across Beal's Branch. C. E. Holstein, co. clk.

STREET LIGHTING.

Linwood, Kan.—Voted to issue bonds for constructing an electric light plant.

Geneva, N. Y.—Bids will be asked soon for lighting this city for a term of years.

Okemah, Okla.—Voted to issue bonds for constructing an electric light plant.

Wichita, Kan.—Plans have been completed for constructing a new power plant for Fairmount College.

Portland, Ore.—Bids are asked until Aug. 31 for lighting the streets, avenues, parks, public grounds and places with electric arc lamps, and the public buildings with incandescent electric lights. Cy. audt.

Slingerlands, N. Y.—Sealed bids are asked until Aug. 12 for lighting the streets of Delmar. Geo. J. Coughtry, town clk., Slingersland.

Cranford, N. J.—Bids are asked until Aug. 5 for street lighting, consisting of 211 incandescent lights, 25 c. p., and 11 arc lights. Jas. E. Warner, twp. clk.

Danvers, Mass.—This city has authorized the issue of bonds for improving and additions to the municipal electric light plant. E. B. Nichols, mgr.

Saratoga, N. Y.—Bids are asked until Aug. 7 for furnishing arc, incandescent or other lights for streets and public buildings for 4 years. Philip S. Wakeley, vil. clk.

Green Bay, Wis.—Bids are asked until Aug. 18 for installing conduit and wiring system in the U. S. Postoffice and Court House. Jas. Knox Taylor, suprv. arch., Washington, D. C.

New York City.—Bids are asked until Aug. 4 for furnishing 111,000 incandescent electric lamps for the quartermaster's department; also, alternate proposals for furnishing 373,500 of these lamps to be delivered to the treasury and quartermaster's departments. Wm. S. Patten, depot Q. M., 39 Whitehall st.

Spokane, Wash.—The board of public works adopted a resolution directing the city engineer to communicate with other cities operating municipal electric light plants, with a view to obtaining information regarding the establishment of a municipal plant here.

Great Falls, Mont.—Special.—John D. Ryan has announced that they will expend $1,500,000 in the development of the water power and other improvements at this city. Mr. Ryan is the head of the syndicate that recently purchased the Great Falls Water Power and Townsite Co.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Terre Haute, Ind.—The city council has authorized the issue of bonds for constructing a garbage crematory.

El Paso, Tex.—G. W. Fuller, cons. engr. of New York City, has recommended an incinerator for garbage disposal.

Buffalo, N. Y.—Special.—John Martin submitted the lowest bid, July 22, for cleaning the streets by the machine system, at $115,000 a year, or $575,000 for 5 years.

Buffalo, N. Y.—Special.—The Buffalo Fertilizer Co. has been awarded the contract for collecting ashes and garbage for 5 years at $196,700 a year.

PARKS.

Waterloo, N. Y.—General improvements to the village park are contemplated. C. A. Genung, park comr.

Potsdam, N. Y.—R. L. Sisson, F. L. Dewey and L. C. F. Ball have been appointed a special committee to arrange for general improvements to the village park.

Buffalo, N. Y.—Special.—Plans are being made by the Buffalo Park Commission for improving Cazenovia Park by dredging out the park lake and building dikes and dams, at a cost of about $20,000.

FIRE APPARATUS.

Scranton, Pa.—Bids are asked until Aug. 6 for furnishing 3,000 ft. of fire hose. F. L. Wormser, dir. pub. safety.

Oklahoma City, Okla.—The town bd. of Capitol Hill is discussing the question of purchasing a chemical fire engine.

Willimantic, Conn.—This city has decided to purchase 1,000 ft. of fire hose and has asked for an appropriation for that purpose.

WHAT DO YOU WANT ?

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Do you want Machinery or Supplies

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A **"Want"** advertisement in MUNICIPAL ENGINEERING will be the most thorough, the least expensive and the surest way of finding the opportunity you seek. Rate 1½ cents per word each insertion; minimum charge, 50 cents.

WANTED—Superintendent of experience on municipal work, especially asphalt. The Parker-Washington Company, St. Louis, Mo.

Sealed bids will be received until Aug. 4, 1908, for paving 11 blocks on Third st. with asphalt. Mr. C. A. Ficke, chairman, will furnish specifications for this work upon request. Ficke & Ficke, 228 W. Third st., Davenport, Ia.

CEMENT OPPORTUNITY in Middle California. Limestone and Clay for Portland Cement; lying close together and close to railroad with gravity grade. Supply inexhaustible and cheap fuel and power at hand. Also big deposits of pure Gypsum for Plaster Paris. Sale or lease. Address W. G. Slauson, Room 27 Blackstone Bldg., Cleveland, Ohio.

NOTICE TO CONTRACTORS.

Sealed bids will be received until 12 o'clock noon, Aug. 10, 1908, to improve Frankfort st. in the village of Minster, O., by grading, setting curbing, laying in the necessary tiles, manholes, and the paving of 5,800 sq. yds. of paved street. Joe Laufersweiler, corporation clk., Minster, O.

NOTICE TO CONTRACTORS.

Sealed bids will be received at the office of the city clerk of Guthrie, Oklahoma, until 4 o'clock p. m., of Thursday, August 6, 1908, for the construction of District Sewers Nos. 39 and 40, provided for by Ordinance Nos. 931 and 934, according to plans and specifications now on file in the office of the city engineer of Guthrie, Oklahoma, where bidding blanks and specifications may be obtained.

The mayor and council reserves the right to reject any and all bids. Each bidder to submit with his bid a certified check in the sum of $300 on each sewer, to be returned to him if he is not awarded the contract, otherwise to be retained until he has entered into contract and made satisfactory bond approved by the mayor and council, and in the event of his failure to do so within ten days from the award of the contract, the same shall be declared forfeited and be cashed by the city treasurer and applied to the sewer fund of the city.

Done by order of the council, this 3rd day of July, 1908.

E. W. KINNAN, City Clerk.

SEWER PROPOSALS WANTED.

Sealed bids will be received by A. R. Baird, city clerk, up to 5 o'clock p. m., Thursday, August 6, 1908, for the construction of a sewer 2,315 feet in length, beginning at a point near the Illinois Refrigerator factory and extending west one block, thence in a southerly direction along Willow street to a point on Rock Creek, in accordance with plans, specifications and profile now on file in the city clerk's office. A certified check for $200, payable to the city treasurer, must accompany each bid. The right is reserved to reject any or all bids.

F. A. VAN OSDOL, Chairman.

Morrison, Illinois, July 21, 1908.

W. H. Hill Construction Co.
STREET AND SEWER WORK
101 So. 6th St., EAST ST. LOUIS, ILL.

Peerless Hand Street Sweepers
J. S. BARRON
127 Franklin St., New York

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Specialists in the construction and erection of Rope Drives, Gearing, Friction Clutches, Special Pulleys, Ring Oiling Bearings, and Crushing Rolls for fine or coarse grinding. Send for Catalogue.

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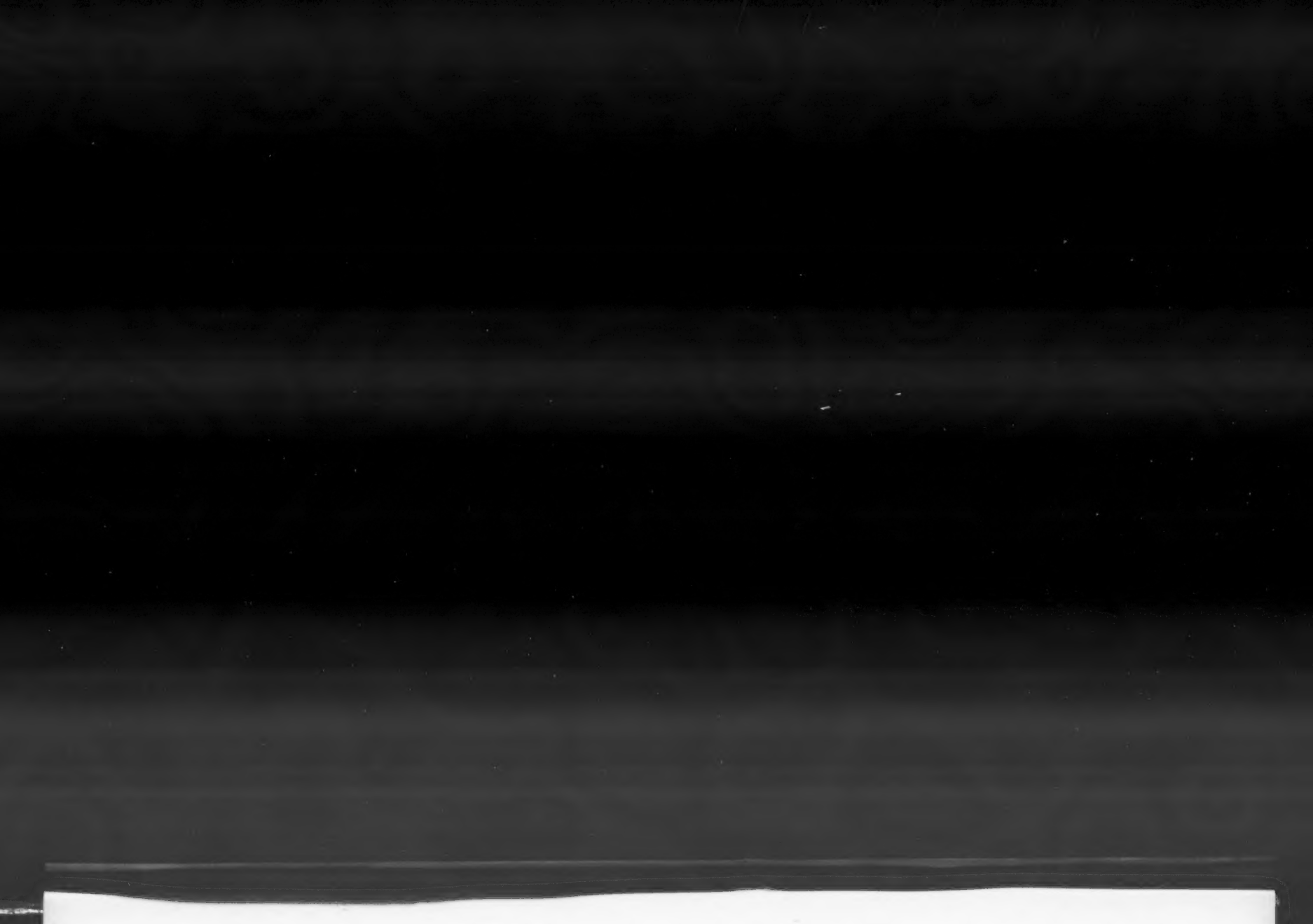
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